AN ANALYTIC STUDY OF VISUAL PERCEPTIONS*

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CHAPTER I

INTRODUCTION

The study of perception has had a long and involved history,—a history which extends, as we may suppose, far beyond the years of written record. The obvious dependence of life upon the use of the senses must have suggested one of the very earliest of all the human problems concerned with mind; and in due time, as we know, primitive curiosity and conjecture came to be supplemented by centuries of reflective and scientific inquiry into man's perceptual means for knowing the world. The implication of mind, however, in the direct apprehension of present objects has not by any means limited the study of perception to the psychologist. The philosopher, the logician, the anatomist, the physiologist, and the general student of life, as well as the psychologist, have derived problems from, and erected theories upon, the facts of perception. These facts have had their bearing upon the character, the trustworthiness, and the limitations of knowledge, upon the substance of reality and the nature of truth, upon the construction and the operations of the senses, and upon the mutual relations of the organism and its surroundings.

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Our own study is to be limited to the psychological aspects of perception. All of the other aspects we shall leave out of account. And within psychology itself the field of perception is so broad and the problems so diverse that we shall be obliged to propose still further restrictions upon the range of our inquiry. It is principally of the *analysis* of certain perceptions that we shall treat. We have chosen this part of the whole problem both because analysis has been neglected, even in experimental treatises, and because a description in analytic terms seems to us to be fundamental to any scientific treatment of mind.

In the following investigation we shall first approach our subject from the historical side to distinguish the old from the new and to set our own problems and methods in a clear and significant relation to others.

A. The Meaning of the Term 'Perception'

1. *Historical summary.* Until recent times two widely divergent views of perception were current in the history of psychology; two views which show a general correspondence to the ancient dualism of activity and passivity. As applied to mental facts at large, the one side of the dualism conceives of mind as an agent or power, actively manifesting itself in the world; the other side conceives of it either as a product or as a reflection of nature, but without dynamic or creative attributes. As regards perception, the one view presents a faculty by which the mind or the soul puts forth its power in the apprehension of surrounding objects; the other view presents a kind of knowledge, mediated by the senses and constructed according to a principle of association or to some law of bodily functions. The two views are to be traced through the long history of reflective thought, the emphasis placed now upon the one side and now upon the other, according to the temper of the philosophical, theological, and scientific theories of the time.

The first way of treating the problems of perception has been common since the time of Plato; the second attained its greatest prominence in the eighteenth century through the development of the doctrine of "sensationalism."

Plato[1] and Aristotle[2] are among the earliest of western philosophers to consider perception as a faculty whence the mind or soul derives its knowledge of the physical world. The inlet of this knowledge

[1] Plato, *Theatetus* (Ed. I. Burnet, Oxford), Sec. 151-152; *Republic* (Ed. Stallbaum). V. xxi; VII, vii.

[2] Aristotle, *De anima* (Ed. F. A. Trendelenburg), II, iii-xii; III, i-ii.

was by way of the sense organs, through which impressions passed. These impressions, once received, were organized by the soul (Plato) or the common sense (Aristotle).

The Platonic and Aristotelian view of perception was destined to exert an influence for many centuries. Restatements of the doctrine are to be found in Descartes, in Locke, and in Leibniz. In the system of Descartes,[3] perception is called a "function," but "function" is only the older "faculty" in disguise. And as with Plato, so with Descartes, the soul is the unifying agent for the various impressions of sense. Leibniz[4] likewise adheres to an interpretation of the soul in terms of faculties. The entire universe is composed of dynamic monads, which are ordered from the lowest to the highest according to their ability to perceive. In the human being, the monad or soul becomes a means of unification for all activities,—a conception which is strongly reminiscent of Plato and Aristotle. Perception, which ranges from obscurity to clarity, is regarded as one of the innate activities of the monad. Like Descartes and Leibniz, Locke[5] regards perception as an activity or power. He maintains that it is the primary faculty for receiving knowledge about the physical world. Not every impression upon the sense organ, however, gives rise to a perception. Whether or not it does, depends upon the frequency of its occurrence, and also upon the mind's preoccupation with other ideas. For Locke, however, perception is more than a faculty or power; it is also the material of knowledge. Through the medium of sensations the organism perceives objects as possessing the primary qualities of extension, motion, number, and figure, as well as the secondary qualities of sound, color, and the like.

By all these writers, then, perception has been regarded as a capacity, power, or faculty of mind, with the qualification that in Locke, although defined as a faculty, it is also regarded as a kind of knowledge originating in "sensation." After Locke, the notion that perception results from the combination of sense-impressions received elaborate exposition at the hands of the "associationists." Hume expressed this view when he said concerning perceptions of space and of time that "there is another very decisive argument, which establishes the present doctrine concerning our ideas of space and time, and is founded only on that simple principle, *that our ideas of them are compounded of parts which are indivisible.*"[6]

Much later, Bain[7] enlarges the meaning of perception beyond that of the sensationalists. He departs from the interpretation of the latter both as to composition and as to function. Besides bare sensory impressions, muscular feelings are also included in the materials of perception, and the process becomes more highly intellectualized than before. The criterion which now determines whether a process is intellectual or sensory is discrimination, or the feeling of a difference. The fundamental fact of perception—namely, that it is the result of association,—signifies that several constituents are present and

[3]Descartes, R., *The passions* (Ed. C. Adam and P. Tannery), Sec. xvii, xix-xxxv.

[4]Leibniz, W. G., *Monadology,* 1714, Sec. 14, 19, 21.

[5]Locke, J., *Essay concerning human understanding,* London, 1823, Bk. I; Bk. II, chap. 9.

[6]Hume, D., *A treatise of human nature,* 1748, II, iii.

[7]Bain, A., *The senses and the intellect,* N. Y., 1874, 364; *The emotions and the will,* N. Y., 1876, 549.

are accompanied by a feeling of difference between the successive or coexisting impressions. Bain anticipates James in this distinction between perception and sensation, making the difference one of kind as well as of degree of knowledge. James maintains that perceptions and sensations resemble each other, but are not identical. Perception differs from sensation in that it implies "consciousness of farther facts associated with the object of sensation."[8]

The principle of associationism was adopted by the French psychologists, Condillac and Bonnet. Condillac worked out an elaborate system of sensationalism. Every capacity of the soul is derived from sensations, between which are established associative connections.[9] He anticipates Herbart's mechanics of ideas in assuming that some impressions and presentations are favored by desire and attention, while others are kept in the background. Like Condillac, Bonnet derived all mental life from sense impressions, but instead of resulting from the association of sensations, everything was to be interpreted in terms of nervous mechanisms. The description of mind becomes a "psychology of the nerve-fibres."[10] Perception originates from simultaneous and successive excitations which give rise to sympathetic movements in connected or contiguous tracts.

In the German psychology of the eighteenth century, accounts of perception were given both in terms of faculty, as expounded by the philosopher Christian Wolff, and in terms of the sensationalism of England and France. Later, in Herbart,[11] perception—like all other mental phenomena—was reduced to the single, primary act of presentation (*Vorstellen*). It was the result of fusions and complications. Herbart's emphasis upon the fluid and the dynamic aspects of mind has exerted a strong influence in the subsequent scientific period. But it is principally Wundt's insistence upon mental analysis in terms of process, that has given us the doctrine of perception as a typical mental formation whose members are the simple processes of sensation and feeling.

2. *Recent and contemporary uses of 'perception.'* As in earlier times so also during the scientific period, the word 'perception' has been put to two unlike uses,—uses which are similar to, but not identical with, the older dualism. First, it is treated as one of the major *functions* of the mind after the pattern of the active powers or 'faculties,' and, secondly, it is more passively regarded as a *composite* of individual processes. Functionally treated perception becomes a performance, an accomplishment, or the discharge of a service;[12]

[8] James, W., *The principles of psychology,* N. Y., 1890, II, 77.

[9] Dessoir, M., *Abriss einer Geschichte der Psychologie,*. Heidelberg, 1911, 114.

[10] Klemm, O., *Geschichte der Psychologie,* Leipzig, 1911, 98.

[11] Herbart, J. F., *Lehrbuch zur Psychologie,* 1834, Sec. 55-56.

[12] These interpretations agree in general with the definitions of function as proposed by Ruckmich, C. A., (The uses of the term function in English textbooks of psychology, *Am. J. of Psychol.,* 1913, xxiv, 99); and by Dallenbach, K. M., (The history and derivation of the word 'function' as a systematic term in psychology, *ibid.,* 1915, xxvi, 473).

more passively and descriptively regarded it is an organic whole, analyzable into component parts. On the side of function the perceptual performances may be purely mental, as knowledge of environment, cognition of the world,—or it may be a psychophysical function which the whole organism expresses in overt or inhibited action. The first is the cognitive, the second the biological or psychophysical function of perception.

Among the writers interpreting perception as a composite of elementary processes,—to discuss first the analytical use—are to be found Wundt, Titchener, Angell, James, Binet. Perception thus considered is organized, *i.e.,* its constituents are arranged in definite configurations and patterns. The exact nature of these constituents varies from author to author, but there is a general agreement as regards sensational and imaginal processes, both of which vary from individual to individual and from perception to perception. Not only do images arise with sensations to form perceptions, but affections are, according to Wundt,[13] also regarded as constant, component parts. This affective component is less regarded in perception by Titchener, Angell, and James. A "pure" perception would be composed of sensations alone, but this seldom exists. There are usually imaginal accompaniments, the kind depending both upon individual constitution and upon the previous setting of similar experiences.

Again, there are other writers who propose another kind of constituent for the perceptual complex, a formal or 'funded' quality.[14] Over and above the sensational and imaginal processes, these writers profess to find something which determines the perceptual complex and which is 'subjectively' added. The chief exponents of this theory have belonged to the Austrian school, among whom are Ehrenfels, Meinong, Cornelius, and Witasek. The real value of their contention lies, not in the discovery of new and unique members or factors in the perceptual complex, but upon the fact—overlooked by traditional sensationalism—that the perception has characteristics, properties, and functions which distinguish it and which disappear when the complex undergoes analysis.

Where perception is thus regarded process-wise as a group of integrated and organized members, it is obvious that its cognitive aspect,—its meaning,—has separately to be considered. The relation of process to meaning in perception has been variously conceived. Some writers agree in regarding images as the most important factor for giving purport to the complex. According to the Wundtian doctrine of 'context,' as expounded by Titchener,[15] it is the background (either imaginal or sensational) which gives significance to the perception.

When regarded functionally, perception wears a different aspect and it provokes a different kind of scientific inquiry. Let us consider it first as a mental function and afterwards as a psychophysical func-

[13]Wundt, W., *Grundzüge der physiologischen Psychologie,* Leipzig, 1911, III, (6th ed.), 296.

[14]See Bentley, M., The psychology of mental arrangement, *Am. J. of Psychol.,* 1902, xiii, 269.

[15]Titchener, E. B., *A textbook of psychology,* N. Y., 1915, 367. *Cf.* Angell, J. R., *Psychology,* N. Y., 1908, 156.

tion. The first kind finds an exponent in Stout, who describes perception as "essentially cognition,"[16] which signifies that the mind acquires knowledge of objects by means of a cognitive performance. Stout has been influenced by James; but James was interested in the biological or psychophysical as well as in the cognitive functions of perception,[17] according to which the response of the organism or at least the motor discharge forms a part of the perception as essential as are the afferent impulses. Such a view is sustained, *e. g.*, by Dewey, who, in opposition to Stout, defines perception as primarily a fact of action, not one of cognition.[18] The perceived objects are arranged about our bodies as centers and our field of perception increases and varies with the growth and needs of the organism. From action to adjustment is a short step, and it has become common for writers whose main interest lies on the biological side to affirm that the adaptation of the organism to its surroundings is the primary function of perception.[19]

This emphasis laid upon the functional aspect of perception recurs likewise in studies in comparative and genetic psychology and in behaviorism. Watson, who stands for behaviorism as a substitute for psychology, speaks constantly of the "sense functions," which really include perception, as shown by some of the problems suggested under such headings, *e. g.*, "the rôle of vision in daily life," and "the response to ordinary sounds in the animal's environment."[20] Baldwin,[21] too, in his statement of genetic problems, emphasizes the fact of "functional epochs," or the child's acquisition of knowledge through direct experience.

We may, then, summarize our historical sketch by remarking upon the persistence through many centuries of the 'active' and 'passive' views of perception. Until recent and more scientific times perception was either a power, a faculty, of the soul, or else the mere reception of 'impressions' to be connected and elaborated by 'association' or by the nervous system. Under the conjoint influence of the other sciences and of experiment within psychology itself, the dualism of active and passive has been modified, but it still persists in the functional and analytical accounts of perception. The one looks upon perception as a mental or psychophysical performance, of use either to knowledge or to the organism; the other describes it in terms of integrated processes.

With these gross distinctions, historical and current, in view, we turn to an inspection of the actual problems and methods which are to be found in the recent literature of our

[16]Stout, G. F., *A manual of psychology*, N. Y., 1899, 241.

[17]James, W., *The principles of psychology*, 1890, II, chap. xix.

[18]Dewey, J., Perception and organic action, *J. of Philos., Psychol., Etc.*, 1912, ix, 645.

[19]Judd, C. H., What is perception? *J. of Philos., Psychol., Etc.*, 1909, vi, 36; Aaronson, I., Perception, *ibid.*, 1914, xi, 37.

[20]Watson, J. B., *Behavior*, N. Y., 1914, 33-36.

[21]Baldwin, J. M., *Mental development, etc.*, N. Y., 1895, 1ff.

subject. But in order to describe these problems and methods we must first glance at the classifications of perception to be found among modern psychologists. Our inspection of kinds, problems, and methods, should be a useful means to orientation within the field of our own experimental studies which we are presently to enter.

B. Perception in Modern Psychology.

1. *Kinds and classes.* In order to discover an adequate basis of classification, we may review the treatment accorded our subject by such systematic psychologists as Wundt, Külpe, Titchener, Angell, Pillsbury, Stout, and Ebbinghaus. Consonant with our historical summary, we find, in these systems, that perceptions are classified either (a) as modes of integration of component processes or (b) according to the kinds of knowledge which they mediate.

(a) Classification of perceptions as modes of integration. Wundt is one of the chief exponents of a distinction made in terms of the manner of combination of the elementary processes. Perceptions are, for him, fusions, complications, and assimilations.[22] An association of elements by fusion may be intensive or extensive. By intensive fusion he means that interconnection which exists between processes by virtue of their qualitative relationship, *e. g.,* the clang. This kind of affinity between mental processes exists only among those arising from the same sense-department and from sensory stimulation. The term 'fusion' is extended to other forms, spatial and temporal, where it is designated as extensive. If the perception, on the other hand, arises from a union of sensations from different sense-departments, as a perception of water from visual and cutaneous processes, then it is known as a complication. These two modes of integration account for perceptions that are composed of only present experiences. There are, however, other perceptual complexes in which reproduced experiences play an important part, as the perception of any familiar object which contains more than the bare sensory processes. Whenever image combines with sensation to form a perception, the integration is known as an assimilation.

Külpe and Titchener also classify perceptions according to the mode of integration of the component factors. The modes of perceptual integration according to Külpe differ but slightly from those of Wundt. Külpe's classification includes fusion, colligation, and association.[23] Fusion is defined as a qualitative connection between elements when they are spatially and temporally identical, *e. g.,* if two notes were simultaneously given, the tones would be temporally identical but qualitatively diverse. Fusion, then, from Külpe's point of view, is only one (the intensive) phase of Wundt's fusion. The spatial and temporal perceptions are designated by Külpe as colligations. For example the tone a^1 repeated with alternately long and short intervals, would be an instance of identical quality but of different temporal

[22] *Grundzüge,* III, (6th ed.), 500ff.
[23] Külpe, O., *Grundriss der Psychologie,* Leipzig, 1893, 284ff.

relations and it would fall accordingly into a temporal colligation, rhythm. A pattern of colors would illustrate the spatial kind of colligation. Furthermore, elements not only unite qualitatively, spatially, and temporally, but they integrate also because each tends to establish a relationship between itself and other processes. So arise associative combinations.

According to Titchener, perceptions are distinguished as qualitative, spatial, temporal, and mixed.[24] The first three would all be grouped as fusions, intensive and extensive, by Wundt, save that Titchener's qualitative complexes also include Wundt's complications, and Titchener's mixed type is virtually equivalent to Wundt's assimilation.

In general, then, with slight limitations and expansions of terminology, Wundt, Külpe, and Titchener make similar classifications of perception. Their distinctions between kinds or types depend mainly upon the capacity of the sensory processes to integrate qualitatively, spatially, or temporally, or upon the fact of images attaching themselves to sensations to form perceptions.

(b) *Classification of perceptions based upon kind of knowledge.*

A classification of perception from this point of view depends upon an interpretation of it from its functional aspect. Stout, Angell, Pillsbury, and Ebbinghaus treat it in this manner. Stout enumerates five kinds: perception of external or physical reality, of space, time, causality, and 'thinghood.'[25] A glance at these terms will disclose the emphasis placed upon the cognitive function. In order to have any perception at all there must be some external or physical object, even the body or its parts becoming external to the self when cognized. Besides being external, every object must possess unity, identity, and independence, by virtue of which it is perceived as distinct from every other object. This distinctness is designated 'thinghood.' Furthermore, an object, besides being external to the organism and distinct from every other object, may also be thought of as causality, or as the result of a gradual, practical adaptation, whereby through past experiences the organism becomes aware of the object's efficiency or inefficiency. In all of these categories of perception the importance of knowledge or information about objects is the outstanding factor. Likewise, perceptions of space are such as have to do with information about some physical object, for space is a matter of relations in position and distance, and position and distance must pertain to objects. What is true of spatial perceptions is also true of temporal, *i. e.,* time bears relation to something, as to the past, present, and future.

Angell, Pillsbury, and Ebbinghaus likewise draw distinctions between the large classes of perception according to the kind of knowledge derived. Angell, however, limits all perceptions to two main classes, spatial and temporal. Every perceived object implies a spatial and a temporal order. Each class has its own peculiar function: by means of spatial perceptions the organism becomes accommodated to a three-dimensional world; by means of temporal perceptions, to a "world of sequential events."[26] Thus, by virtue of knowledge concerning the outside world acquired through the perceptual functions the living being adjusts itself to its environment.

Pillsbury does not vary much from Angell's position. The chief concern is, he says, the tracing of "factors that aid in the transforma-

[24] *Op. cit.,* 389.
[25] *Op. cit.,* 312.
[26] Angell, J. R., *op. cit.* N. Y., 1908, 172.

tion of the sensations into objects."[27] During this procedure, it is also necessary to keep in mind the way in which "elementary mental states come to mean that which they are not." For him, the meanings, or informations, are of much more importance than the formation or integration of the perception. The kinds of meaning, or knowledge, which are obtained by way of the perceptual process are fusions, and spatial and temporal relations. Besides these, the mind may also become aware of movement of change, and of rhythm. The former is related both to space and time, the latter primarily to time. We see, then, that these types of perception are not essentially different from those of Angell and Stout. They stand related to those of the former in that fusion, movement, and rhythm are perceived as parts of a spatial and temporal order; to those of the latter by virtue of the fact that in so far as adjustment and reaction to objects greatly aid in the perception of them, objects as perceived, whether as fusions, movement, or rhythm, must possess physical reality, causality, and 'thinghood.'

Finally, the classification of Ebbinghaus, although it appears to be of the first or integrative kind, is at bottom functional. The general (*gemeinsame*) or formal attributes, unity, identity, plurality, difference, and the like,[28] which Ebbinghaus assigns to sensations, are really functional marks, so that his account of perception is really not at all a description of mental processes but a description of the kinds of knowledge to which perceptions give rise. Ebbinghaus has therefore to be grouped with Stout, Pillsbury, and Angell, rather than with Wundt, Külpe, and Titchener.

In general, then, it may be said that those psychologists who base their classification of perception upon kind of knowledge derived are emphasizing the functional aspect. Furthermore, this division of the types of perceptions may be as various, with respect to terminology, as the relationships of object to object and of object to organism may suggest. On the other hand, those who have distinguished classes of perception upon the basis of integration have placed the main emphasis upon the fact that perception is an organized complex made up of elementary processes.

The recent insistence in some quarters upon the adaptive functions of mind leads the student of perception to look for a third kind of classification which should take into account the facts of organic adjustment. Systematic work of this kind seems, however, not to have been done. Where general terms have been demanded by the biologizing psychologist, the older, cognitive distinctions seem to have been transferred,—by a comfortable logic,—to the ecological kind of function.

2. *Problems of perception.*[29] With this historical back-

[27]Pillsbury, W. B., *The fundamentals of psychology,* N. Y., 1916, 269.

[28]Ebbinghaus, H., *Grundzüge der Psychologie,* Leipzig, 1911, I, 442.

[29]For a basis of determination of the problems and methods of perception, approximately 150 investigations have been examined. For this purpose, the studies upon perception reported in the following

ground in view, let us turn to the empirical problems which the subject of perception has presented, and then proceed to the methods employed for their solution. The problems may be grouped under the following eight headings:

i. Dependence of perception upon variations of stimulus as to its (a) kind, (b) temporal peculiarities, (c) spatial arrangement, and (d) degree; perception is either (1′) analyzed in terms of process or (2′) referred in terms of meaning to variations in stimulus.

ii. Dependence of perception upon organic conditions: (a) general, and (b) local.

iii. Dependence of perception upon the general state or condition of mind.

iv. Relation of perception to organic movement.

v. Deranged perceptions: synaesthesias, illusions, hallucinations.

vi. Relation of perception to thought.

vii. Nature of perception in animals.

viii. Development of perception: (a) phylogenetic, and (b) ontogenetic.

An examination of the recent experimental literature will serve both to define and to illustrate the numerous perceptual problems which have already been formulated. We shall take them in order.

i. Dependence of perception upon stimulus

The problems of perception which depend upon the control of the stimulus present many and several phases, since the stimulus may be widely varied with respect to its various characteristics. The task then resolves itself into (1′) the analytical description of the sensational and imaginal processes making up the perception under variations of stimulus, or (2′) the correlation of change in meaning with change in stimulus. Either of these modes of interpretation of results may be the aim of the investigation under any of the four possibilities of modification which have been distinguished.

(a) Dependence of perception upon change in kind of stimulus. Under this sort of quest the three remaining aspects of stimulus, time, arrangement, and degree, are kept as constant as possible, while modifications in kind are made under control, in order to determine any difference in the perception which may result. The investigation by Kemp[80] into tonal fusion furnishes an excellent example of this

periodicals were scrutinized: *Am. J. of Psychol.*, 1903, xiv—1916, xxvii; *J. of Animal Behav.*, 1911, i—1916, vi; *J. of Philos., Psychol., Etc.*, 1910, vii—1916, xiii; *Psychol. Rev.*, 1908, xv—1916, xxiii; *Brit. J. of Psychol.*, 1904-05, i—1915-16, viii, Pt., 3; *L'Annee psychol.*, 1910, xvi—1914, xx; *Arch. f. d. ges. Psychol.*, 1909, xiv—1915, xxxiv; *Psychol. Stud.*, 1905-06, i—1907, iii; 1911-12, vii—1913-14, ix; *Psychol. Index*, 1915, xxii (all references quoted upon perception); and many other volumes and periodicals not here quoted.

[80] Kemp, W., Methodisches und Experimentelles zur Lehre von der Tonverschmelzung, *Arch. f. d. ges. Psychol.*, 1913, xxix, 139.

part of the first problem. Two notes of unlike vibration rates were presented to the observers, who were instructed to compare the tonal complexes as regards degree of fusion. The introspective reports, however, were not highly analytical.

Experiments in which mere changes in meaning are reported, and in which the aim is to refer these changes to modifications in the character of the stimulus are illustrated by Woodrow's[31] study of rhythm. The influence of the intensive and temporal factors was minimized or eliminated, thus producing the most favorable conditions possible for correlations between qualitative changes in perception and variations in the nature of the stimulus.

(b) Dependence of perception upon the temporal properties of the stimulus. Perceptions of rhythm and intervals of time are directly influenced by any temporal modifications in the stimulus. Experiments which illustrate this were devised by Ross[32] and Wallin.[33] In the first investigation, a series of ten clicks, all at constant intervals with one exception, wherein the time was shortened, was provided. The task of the observer was to detect the exceptional interval. The perception of this particular duration was described only by its detection, when compared with another, constant time, *i. e.*, it was described only in terms of meaning, not of process.

On the other hand, Wallin determined not only changes in meaning, but also the processes which underlie the perception. The observers were asked to find a tempo midway between two others, one fast and one slow. With the quantitative results were also recorded comments made by the observers upon the aids employed in the perception and the determination of the temporal rate. Wallin reports, *e. g.*, that "four believed that they based their estimations on the immediate impressions," "practically all the subjects made use of the kinaesthetic factors," or again, "only three were conscious of using any visual imagery."[34] Although these comments are not true introspections made in terms of process, they show more of a tendency in that direction than the reports of the observers in Ross' experiment.

(c) Dependence of perception upon the spatial arrangement of stimulus. The possibilities of modifications in the spatial pattern of stimulus are illustrated in many investigations into those perceptions which owe their configurations and meanings primarily to the spatial arrangement of the exciting agency, *e. g.*, perceptions of lines, depth, size, and form. Such an experiment as Cook carried out upon the cutaneous estimation of filled and unfilled space, is a case in point. Aesthesiometers for punctual and continuous impressions were used.[35] The problem—the determination of the amount of illusion present in the comparison of filled and unfilled spaces—assumes a change of perception corresponding to a change in the spatial relationships of the stimulus.

We find, however, other investigators describing the perception both as meaning and as process. In an experiment upon reversible

[31]Woodrow, H., Rôle of pitch in rhythm, *Psychol. Rev.*, 1911, xviii, 54.

[32]Ross, F. B., The measurement of time-sense as an element in the sense of rhythm, *Psychol. Monog.*, 1914, xvi (No. 69), 166.

[33]Wallin, J. E. W., Experimental studies of rhythm and time, *Psychol. Rev.*, 1912, xix, 271.

[34] *Ibid.*, 295.

[35] Cook, H. D., Die taktile Schätzung von ausgefüllten und leeren Strecken, *Arch. f. d. ges. Psychol.*, 1909-10, xvi, 442.

drawings, Becher,[36] *e. g.*, has discovered not only that different meanings arise under spatial differences of stimulus but also he has identified the mental processes which correspond to these differences.

(d) Dependence of perception upon the degree of stimulus. Such an investigation as was conducted by Arps and Klemm[37] upon the relation of intensity to the localizing of sound will illustrate this point. The source of the sound was a tuning fork, which could be moved in either the median or transversal plane of the head. The sound itself was transmitted to the observer by means of a telephonic connection. The observer's task was to compare one sound with another of like physical intensity but in a different position, or with a sound at the same distance as the first, but of unlike intensity. Since the duration and equality of the sound were constant, its intensity was the determining factor for localization. Since the investigators were concerned with spatial localization, their problem was of the second or cognitive type.

ii. Dependence of perception upon organic conditions: (a) general, and (b) local.

(a) The perception of an object may be greatly influenced by the general state of the organism. For example, one experimenter, Jones,[38] permitted himself to be anaesthetized with chloroform in order that he might introspectively observe the effect upon his mental processes. He found not only that perceptions were the first mental processes to drop out, but that these also changed as they disappeared. For instance, he says that "all movements made appeared to be much longer than they actually were," that "winking gave the peculiar feeling of a great curtain slowly shutting out the light and as slowly rolling back again," and numerous other instances of perceptions which were modified by the anaesthetized condition.

(b) Every perception depends upon the condition of its particular sense organ, consequently modifications of local organic conditions result in modifications of the mental correlates. Perceptions which indicate directly such an influence are the difference in the perception of size by different parts of the retina, the perception of the position of objects with the head held at various angles, and the different perceptions of the same pattern upon various parts of the skin. The first depends upon the local conditions of the retina; the second, upon organic conditions within the head; the third upon the distribution and 'local sign' of the pressure organs in various parts of the skin. For illustration, we may cite Stevens' experiment upon peripheral vision.[39] By use of one of the psychophysical methods, the author determined the perceived difference in the size of the objects at different parts of the retina.

iii. Dependence of perception upon the general state or condition of mind.

States of this sort are attention, expectation, doubt, hesitation, and

[36]Becher, E., Ueber umkehrbare Zeichnungen, *Archiv. f. d. ges. Psychol.*, 1909-10, xvi, 397.

[37]Arps, G. F., and Klemm, O., Untersuchungen über die Lokalisation von Schallreizen, *Psychol. Stud.*, 1912-13, viii, 226.

[38]Jones, E. E., The waning of consciousness under chloroform, *Psychol. Rev.*, 1909, xvi, 48.

[39]Stevens, H. C., Peculiarities of peripheral vision, *Psychol. Rev.*, 1908, xv, 69.

deliberation. The subject is so predisposed when the stimulus is applied as to affect his perception. In reporting an experiment upon the influence of expectation upon auditory localization, Geissler says[40] "in our method the greatest importance must be laid on the instructions given to the observers and the subsequent reports demanded from them." In other words, he had previously prepared his subjects to perceive the object in a certain position and his task was to determine in how far this mental set affected the localization of the sound.

iv. Relation of perception to organic movements.

In the three groups just reviewed, the task of the investigator ended when he had established and described a perceptual complex under certain conditions of stimulus, body, or mind; but in the fourth group emphasis is placed less upon sensory and imaginal components of the perceptual consciousness and upon conditions than upon resultant and motor tendencies which are sometimes alleged to be factors essential to perception.[41] The following quotation from Judd, who writes in terms of 'reaction' and 'adjustment,' will make the matter clear. "The simplest perception of an object which is presented to the eyes contains a great deal more than sensory elements of which it is composed. It consists of certain forms of arrangement and certain tendencies toward reaction which must be recognized by any student who would work out an adequate account of these processes."[42] Partial or total 'adjustments' are then, for Judd, necessary factors in perception.

From what has just been said concerning the relation of perception to organic movement, it is evident that such writers as Judd are less concerned with the perception itself than with events and occurrences concomitant with, or subsequent to, the perceptual complex, with events which are really the final result and not the components of perception. The chief interest in perception, from this point of view, is a consideration of it as the accommodation of the organism to its surroundings.

v. Deranged perceptions; synaesthesias, illusions, hallucinations.

Some of the problems developing from the study of deranged perceptions are: (a) a description of the processes which comprise the complex; (b) a description of meanings; and (c) an explanation of the cause of such perceptions. This last problem belongs primarily under the second group of problems, or the dependence of perception upon organic condition. A description of a deranged perception in terms of process is difficult, because of the inability and the limited reliability of introspective reports under conditions where such derangements occur. But referring again to the experiment by Jones[43] upon the influence of anaesthetics, we find from his own observations that the distorted perceptions are the result of disturbed sensory processes, *e. g.,* he reported that, at first, the visual sensations were clearer and more intensive, while auditory and tactual processes decreased in clearness, and his deranged perception of movement was the probable sequence of the low intensity of tactual sensations.

[40]Geissler, L. R., Sound localization under determined expectation, *Am. J. of Psychol.,* 1915, xxvi, 269.

[41]Dewey, J., *op. cit.,* maintains that perception is the result of incipient and partial organic responses.

[42]Judd, C. H., *op. cit.,* 40.

[43]Jones, E. E., *op. cit.,* 51.

vi. Relation of perception to thought.

The relations of perception and thought are to be sought for on the side of common properties either of process or of function. With regard to composition, we might expect to find like components and even similarities of integration. Thought would then simply become a complex involving greater elaboration of meaning than perception, due to its greater complexity of composition and differences of function of the component processes. Thought would, from this point of view, be distinguished from perception by degree of meaning rather than as a different kind of mental phenomenon. On the side of function common attributes and properties of the two activities must be taken into account. If perception is considered as cognitive, and thought as elaborative, then there is a wide distinction; but if we look upon perception as accomplishing something more than mere apprehension, then we find that the two functions again approach each other in nature. The problem, however, has never received comprehensive treatment.[44]

vii. The nature of perception in animals.

Here we find two main problems; first, a description of the mind of organisms below man based upon a comparison with the human mind, and secondly, the relation of animal performances to perception. An experiment by Johnson[45] will illustrate the first, in which the ability of monkeys and chicks to discriminate lines or striae of different widths was made the subject of investigation. Limens of discrimination were found for these animals as well as for man. Certain other persons, however, who are chiefly interested in the animal's performance lay no stress upon the analysis of the perception itself. A description in terms of performance, behavior, or response which is directly correlated with physical conditions, suffices for their purposes. We find Watson [46], *e. g.,* taking this extreme view.

viii. Development of perception; (a) phylogenetic and (b) ontogenetic.

The first group of problems listed here presents a large field and a wide range. The investigator who enters upon such a task as determining the development of perception in the animal phyla must possess much ingenuity and versatility in pursuing the many problems which present themselves and in devising methods for their solution. Here would be listed such problems as the modification of perceptual complexes from the lowest to the highest living form, a comparison of differences in perception with differences of nervous system, and a comparison of perception with other mental complexes at the various stages of development in the animal series. The ontogenetic development of perception, on the other hand, does not include such a wide scope, but limits itself to the study of perception within one organism from birth to maturity. Judd and Cowling[47] present a

[44]F. Aveling (Relation of thought-process and percept, *Brit. J. of Psychol.,* 1911, iv, 213) considers the interrelations of thought and the sensational processes as the problems which underlie the relation of thought and perception.

[45]Johnson, H. M., Effective differences in width of visible striae for the monkey and the chick, *J. of Animal Behav.,* 1916, vi, 169.

[46]Watson, J. B., *op. cit.*

[47]Judd, C. H., and Cowling, D. J., Studies in perceptual development, *Psychol. Rev., Monog. Sup.,* 1907, viii, No. 34, 349.

meagre account of the gradual development of a perception in their experiment on the rate of learning to reproduce certain outlined figures. The reproduction was performed, first, with the eyes closed; secondly, with the eyes open and the drawings hidden, and thirdly, under visual control both of the movements and of the drawings. We have already noted (Sec. *iv*, above) that Judd is primarily interested in perception as described in terms of 'reaction' and 'adjustment,' and so again we mark the characteristic failure of introspective description in the experiment just mentioned.

If we glance in review, then, over the problems which are concerned with perception, we see that they come under the eight headings enumerated, which may be further divided, in turn, into two large groups. The first would include the first four problems; the second, the last four. The first would treat of perception in its general relations (a) to the environment, physical and bodily, and (b) to psychophysical preparation or predisposition. The last four groups may be classed together as treating of specific problems: (a) derangements of perception, (b) relation of perception to thought, (c) perception in animals, and (d) the development of perception in the individual and in the race.

3. *Methods of investigating perception.* We have seen that the problems of perception are varied and numerous, and that they correspond to different interests, different points of view, and different modes of systematic formulation. Now as we advance to the discussion of methods and means of solution we may reasonably expect a like variety. The means which have actually been used in the study of perception we have collected from the journals and the monographs, and we find that they may be arranged under the following six categories: (1) logical, (2) introspective, (3) psychophysical, (4) comparative, (5) genetic, and (6) behavioristic. The interpretations put upon these terms agree with those proposed by Ruckmich.[48] The first is a rational principle applied for the sake of interpretation; the second is 'method' taken in the narrower sense; the third, a mode of procedure employed under experimental methods; and the fourth, fifth, and sixth are, primarily, points of view.

i. The *logical method* is the term which I have used to include all those procedures whereby unanalyzed experiences have been brought together in the mass and by reflection interpreted. It is the sort of means which an investigator uses when he reasons out descriptions of mental experiences without subjecting them to experimental control or even to experimental identification. It is a general and uncontrolled

[48]Ruckmich, C. A., A schema of method, *Psychol. Rev.*, 1914, xxi, 401.

manner of investigation to which psychologists still resort. To illustrate the point, we may refer to Aaronson's[49] interpretation of the relation of perception to knowledge and action, wherein he contends without experimental verification that a man of the dullest type would show more knowledge than the most perfectly contrived mechanical being because he is able to comprehend the meaning of the perception and suitably to adapt himself thereto. But there is no hint of experimental control and no test of presuppositions. Again, an application of this same method is shown in Grünbaum's[50] analysis of the psychophysiological nature of visual impressions of movement in primitive man, where analogies are drawn between structure and mental event and between modern and primitive man. Nevertheless,—in spite of its limitations,—the logical method of interpretation and investigation finds a place in solving just such problems as the last mentioned, where experimental control is impossible. It finds further application, too, in the description and interpretation of conscious moments, which are common to a great mass of people, *e. g.*, the conception of an international war which brings the whole reading world into a single group. Here again, a direct survey by experiment would hardly be feasible. But in the problems of perception the logical method should occupy a subordinate place.

ii. *Introspection* is the one method peculiar to psychology alone. By it we mean the direct, controlled observation of mental phenomena for purposes of analysis and description. From these immediate observations the experimenter makes interpretations and correlations of fact. In practice, however, the introspective method is interpreted in two distinct ways: first and primarily, to analyze and describe mental processes; and secondly, to indicate and estimate meanings and relations, *i. e.*, to give information concerning objects and to comment upon the progress of events.

(a) The first application of the method is the one which has received the sanction of modern systematic psychologists, since every kind of mental event presumably lends itself to this means of investigation. There is—as its champions maintain—no single kind of psychical material to which introspection is limited, and therefore, facts gained by any other method may be substantiated by a direct inspection of mind. Titchener has defined and outlined a schema of the introspective method[51] in which he maintains that introspection includes "an attention from the standpoint of psychology, and a record in the terms and under the captions of psychology." He further proceeds to distinguish two forms of introspection, the direct and the indirect; the first being an immediate description of the processes, the second, a description made upon the basis of reproduced processes, or the memorial image. Titchener's account of introspection substantially agrees with G. E. Müller's critical exposition of the preceding year.[52]

[49]Aaronson, I., Perception, *J. of Philos., Psychol., Etc.*, 1914, xi, 37.

[50]Grünbaum, A., Ueber die psychophysiologische Natur des primitiven optischen Bewegungseindrucks, *Folio Neuro-biol.*, 1915, ix, 699.

[51]Titchener, E. B., The schema of introspection, *Am. J. of Psychol.*, 1912, xxiii, 491.

[52]Müller, G. E., Zur Analyse der Gedächtnisstätigkeit und des Vorstellungsverlaufes, *Zsch. f. Psychol. u. Physiol. d. Sinnesorgane*, 1911, Ergbd. v, 64. In describing the method, Müller says, "Von Selbstwahrnehmung rede ich überall da, wo in Beziehung auf einen psychischen Zustand durch unmittelbare Auffassung desselben oder durch Erinner-

(b) The term introspection, used as a description of meanings, as a designation of knowledge-about-an-object, or as running comment upon an experiment does not analyze in terms of process. By its use the observer reports fragmentary knowledge of objects and conditions. Take, for example, the problem of the relation of thought to perception investigated by Aveling, in which the observers were subjected to certain conditions which they reported as 'typical' or 'individual.' No attempt was further made to analyze the processes which carried this meaning. A few samples from the observations of Aveling's[53] observers will bring out the difference between facts gained through the informative method and the materials of introspection strictly taken. The mere description of the meaning is made evident by the following: "I did not see that as a type of a class. It was a letter-scale. The bars were yellow, the support black. I cannot draw it; for the meaning of the instruction came to me and troubled me. There was an inhibition. No word came to consciousness. I at once thought of Nardis' machine. He had one." . . . "It was a pair of bluish nippers. No word came to consciousness. They were closed. I think I saw it as a picture and as type."

The 'informative' variant of the method, which principally records running comments upon the experiment, falls as far short of describing consciousness in terms of processes as does the related type just illustrated, the one which yields bits of knowledge or reflection. No interpretation can be made concerning the actual composition of perception from confessions of the following character. "I can't say much of the first stage. The picture rolls on, but doesn't take a final interpretation at first. I feel there is a preparation for a definite final something. I had confidence of something definite which would come up when the picture was gone. Then I saw other parts, and the previous interpretation was choked down by this new sensation, and so the other never appeared in full consciousness." . . . "it's an awful effort to look at one thing. It's easier to be passive than active."[54] Such reports do not so much describe objects as merely comment upon the attitude of the observer during the period of experimentation or upon the course of the experiment itself.

iii. *The psychophysical methods*[55] have played an important rôle since Fechner's time. They are peculiarly adapted to the study of relationships between stimulus and sensation. Since perception has its origin in the direct stimulation of receptor organs, all modes of procedure which may help to illuminate the relations obtaining between

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ung an denselben etwas konstatiert wird, . . . Wenn es sich um die Schilderung eines äusseren Gegenstandes handelt, kann die Beschreibung entweder auf Grund gegenwärtiger Wahrnehmung des Gegenstandes oder auf Grund der Erinnerung an eine oder mehrere frühere Wahrnehmungen des Gegenstandes erfolgen. Findet die Beschreibung auf Grund gegenwärtiger Wahrnehmung statt, so steht es stets so, dass die zur Schilderung gelangenden Eigenschaften oder Teile des Gegenstandes sukzessiv die Aufmerksamkeit besitzen und ihren Besonderheiten in allgemeinen angemessene, von sprechenden Worten begleitete Apperzeptionen (Erkennungen) erfahren."

[53]*Op. cit.*, 221.

[54]Smith, F., An experimental investigation of perception, *Brit. J. of Psychol.*, 1913-14, vi, 327, 333.

[55]For discussion see Titchener, E. B., *Experimental Psychol.*, II, Pt. II, Introd., N. Y. 1905.

stimulus and the attributes of sensation may be given a place in the study of this topic. The psychophysical methods have most frequently been applied to perceptions in the visual, auditory, and cutaneous fields, but are widely applicable where quantitative results are sought. An illustration of a psychophysical mode of procedure would be such an experiment as the determination of the influence of accommodation and convergence upon the perceptions of depth,[56] wherein the amounts of accommodation and convergence may be accurately measured and correlated with the degree of depth perceived; or, the determination of the influence of expectation upon localization of sound by the number of errors made.[57]

All the methods so far discussed are those peculiar to the psychology of the human individual. The other three modes of procedure which have helped to solve problems of perception are the comparative, genetic, and behavioristic. All of them may be applied to organisms below man as well as to man himself.

iv. *The comparative method* is a mode of procedure peculiar to itself, namely that of inferring animal mind from human mind. One necessary step is a comparison of the animal and human forms in respect to structure, functions, and behavior. When an animal acts in a given manner under given conditions, the investigator constructs the animal mind on the basis of a comparison with human mind placed under similar circumstances, but with due allowances made for differences of structure, function, and manner of living. The literature upon animal psychology reveals many illustrations of this method. A representative instance is furnished by the article by Johnson already cited.[58] Johnson first determines the differences necessary in certain patterns to be perceived as discrete both by man and by the monkey and the chick. He then constructs the mind of the lower animals on the analogy of the human mind.

v. *The genetic method* may likewise be applied to animals. An instance of an investigation carried on to determine the phylogenetic relationship of various organisms is furnished by Hamilton.[59] By subjecting various beings, as men and children of various ages, monkeys, cats, dogs, and a horse, to the same problem under the same conditions, a comparison was attempted between the reactions of the same species at different ages, and between animals of different genera. This manner of approach is also applicable to problems dealing with the development of the individual. For example, the experiment of Judd and Cowling[60] referred to above, presents the problem of the genetic growth of perception in man with suggestions for a method for its solution.

An investigation of mind from the genetic point of view is advocated by Kirkpatrick, Yerkes, and Baldwin. According to Kirkpatrick the methods of genetic and comparative psychologists are similar. He believes that the student interested in mental growth must first know the structure and behavior of the simpler organisms and then,

[56]Baird, J. W., The influence of accommodation and convergence, etc., *Am. J. of Psychol.*, 1903, xiv, 150.

[57]Geissler, L. R., *op. cit.*

[58]Johnson, H. M., *op. cit.*

[59]Hamilton, G. V., A study of trial and error reactions in mammals, *J. of Animal Behav.*, 1911, i, 33.

[60]Judd, C. H. and Cowling, D. J., *op. cit.*

by inference, construct its mental life.[61] Yerkes,[62] likewise, implies the use of inference in the investigation of individual and racial mental development. Emphasis, however, is placed repeatedly upon the observation of organisms, especially upon the observation of behavior and its adaptive functions.

In Baldwin,[63] we find an entire program outlined and carried through. He assumes that mental growth runs parallel to the development of the nervous system. The task involves a determination of the amount of mental development at various levels in the individual. The suggested manner of approach is that of the dynamogenic method,[64] or an interpretation of the development of the mind by its reflection in movement.

vi. *The behavioristic method* does not attempt to describe mental phenomena as does the comparative method. In its extreme form it seeks only to describe movements and to refer them to antecedent stimuli. An illustration of this method is to be found in an experiment by Bingham,[65] wherein no interpretation of mental processes is attempted. Even in the milder forms of behaviorism, perception is scarcely a problem in itself, but only in so far as it is implied in the description and explanation of organic processes. And in the most uncompromising forms of this branch of ecological study, there is no place at all for the problems of perception.[66]

Thus we find that various paths of approach are available in connection with the problems of perception; though only one of them arrives at actual description in terms of process and form of integration. Our six methods fall into two natural groups. The first group, which includes the logical, introspective, and psychophysical forms, involves in various ways the individual whose mind is under investigation. The psychologist who makes use of the logical method bases his descriptions upon a reference, more or less explicit and exact, to facts taken from his own or from similar experiences; the psychologist who employs the psychophysical methods is dependent upon the judgments of the observer; while the introspectionist finds his facts of perception by immediate observation.

The second group, which includes the comparative, genetic, and behavioristic forms, is characterized by a primary dependence upon the observation of overt actions or of other organic activities. From this common starting-point, the three

[61] Kirkpatrick, E. A., *Genetic psychology,* N. Y., 1910, 3.

[62] Yerkes, R. M., *Introduction to Psychology,* N. Y., 1911, 212.

[63] Baldwin, J. M., *Mental development in the child and the race,* N. Y., 1895.

[64] *Ibid.,* 43.

[65] Bingham, H. C., Size and form perception in Gallus domesticus, *J. of Animal Behav.,* 1913, iii, 65.

[66] Pillsbury (*op. cit.* 14), however, maintains that facts gained from the observation of behavior should be substantiated by introspection.

diverge in their several interpretations of behavior. The first emphasizes the comparison of minds of different forms, the second, the development of mind, and the third, the correlation of response with stimulus.

CHAPTER II

EXPERIMENTAL INVESTIGATIONS

A. AN ANALYSIS OF PERCEPTUAL COMPLEXES

Problem and method. The main purpose of these investigations has been to obtain a descriptive analysis of perception. In the first series of experiments the primary object was to study certain fairly simple perceptual formations, laying special emphasis in our description upon (1) the kinds of process involved, upon (2) the modes of their integration, and upon (3) the temporal sequence of the component members. For this purpose, twelve series composed of ten irregular inkblots[67] were used. There were five observers, C, Ra, Ru, S, and V.[68] The observer (O) was seated four feet from the exposure apparatus, a modified Whipple tachistoscope, which was employed throughout the experiments. Two seconds after a 'ready' signal, a card, bearing an irregular inkblot (about 3 cm. x 3 cm.) was exposed for .2 sec. The following instructions were given to O.

"Two seconds after a preparatory signal is given, a visual field will be exposed. After the exposure, an auditory distraction-stimulus will be sounded. At the signal, fixate and attend to the cross. After the exposure period, give (1) an introspective account of all mental processes occurring between the beginning of exposure and the distraction-stimulus, and (2) a verbal description of all objects perceived."

At each sitting, a series of ten cards was completed. The twelve series were repeated twice, wholly or partially, for each observer, once with .25 sec. and once with .5 sec. exposure. The time of exposure was standardized by using a

[67]These inkblots were similar to those used by G. V. Dearborn (A study of imaginations, *Am. J. of Psychol.*, 1897, ix, 183).

[68]The observers who served in these experiments were (in alphabetical order) a graduate student, Dr. Helen Clark (C); an advanced undergraduate, Miss Helen Davis (Da); and five instructors in the department, Dr. J. E. DeCamp (De), Dr. C. Rahn (Ra), Dr. C. A. Ruckmich (Ru), Dr. A. H. Sutherland (S), and Dr. T. F. Vance (V). The writer takes this opportunity to express her sincere appreciation of their services and especially to acknowledge her indebtedness to Professor Bentley for his constructive criticism and supervision throughout the investigation.

single 'standard' card, when timing the apparatus. After the distraction-stimulus, the introspections were recorded by the experimenter, who asked such questions only as were needed to clarify the reports. The O's were all given preliminary training on four series, similar to the main series, before the twelve main series were begun.

Results. From our introspective reports we find that, for the greater part, perceptual complexes are—under our conditions—composed of sensational and imaginal materials. A few representative introspections will illustrate the type of report and the critical analysis made of the experiences:

"First there was a complex of visual sensations, which meant nothing more than an inkblot of some form. The perception of this was not very clear. Then occurred a visual image of the inkblot, very weak, but persistent. After the image, there seemed to be a break in the direction of attention. During this time there was a great deal of eye strain, which meant an endeavor to clear up the meaning. The duration was intermittent and the intensity low. There were also some kinaesthetic processes from the throat, but they were very vague and brought no definite words." (S)

"The greyness values of the blot were very clear, but meant nothing but an outline of some sort. Then came a visual image of a picture of shoes. The spot then *meant* this, and the image was assimilated right into the visual complex. Then came some 'throat' kinaesthesis and visceral sensations, meaning an endeavor to clear up the meaning." (Ru)

Affective processes were very seldom noted, and then seemed to be of minor importance for the perception, since they were usually related to some individual component rather than to the complex taken as a whole. Of the sensational processes, the visual, by virtue of their direct initiation under stimulus, played an important rôle in the total pattern, making up about 26% of the total number of processes or homogeneous groups of processes reported for all exposures by all observers. But when we find further that processes indirectly evoked within the body, the organic and kinaesthetic sensations, compose 39% of the total number, those directly evoked seem to become of relatively less primary importance so far as the 'bulk' of the perception is concerned.

When the organic sensations occurred, they were always general, but with two possible variations: first, the 'thoracic' and 'abdominal' processes were closely integrated and not distinguishable, or secondly, they were not closely fused and either one or the other stood out emphatically from the total complex. These processes by themselves, however, form but a small part (3%) of the entire group for all observers.

Kinaesthesis, on the other hand, represents the largest per-

centage (36) of any particular class of mental phenomena reported. Both muscular and tendinous sensations were observed. The muscular changes involved may be classified with respect to localization; they were either of the general, diffuse, bodily type, or specially localized in some definite part of the body. The classes of 'muscular' sensations as given in the order of frequency of occurrence are: general (474), 'verbal' (348), ocular (178), head (72), chest and face (each 3), neck (2), and hand (1). The instances of tendinous strains are all very definitely localized in the eyes and head, with a frequency of 243.

Beside the sensational processes, both directly and indirectly evoked, introspection also reveals imaginal processes of various classes, visual, auditory, kinaesthetic, and tactual. All imaginal materials considered together form about a third (35%) of all processes; the visual alone, 27%; kinaesthetic, 7%; auditory and tactual each, .6%. From these proportions, it appears that visual imagery is of importance in visual perceptions. The distribution of the various processes in the different temporal phases for all observers is given in Table I, which is composed from 882 exposures of irregular inkblots, distributed among the five observers.

The perceptions of the 882 exposures represent 94 formations which differ among themselves as regards arrangement of processes and temporal course. Since there were 882 exposures, there were, of course, a like number of possibilities of formation. But with all these possibilities the fact that the whole number can be subsumed under 94 configurations implies that perceptions tend to conform to typical integrations. Thirteen 'typical' patterns, those with a frequency of eighteen or more, are given in Table II, where VS and VI stand for groups of visual sensations and visual images, and the subscripts F and D for the kind of meaning conveyed (*cf.* Table I and p. 548). The sign '>" stands between successive phases and the oblique lines separate parallel processes. The total number of these thirteen configurations is 460, or more than half. In Table II they have been grouped according to similarity of process, of mode of integration, and of function.

1. Group I represents integrations of visual sensations (VS), kinaesthesis, and visual imagery (VI). There is but slight variation from formation to formation, the chief difference being one of temporal sequence. General kinaesthesis stands out as one of the essential factors in each pattern. In the last three, the diffuse, bodily kinaesthesis is supplemented

TABLE I

Type of process	SENSATIONAL												
Class	VISUAL							ORGANIC					
Subclass													
Meaning of complex[1]	F	D				A	S						
Temporal phases	1	1	2	3	4	1	2	1	2	3	4	5	
Total number of records of all observers	835	44	27	48	1	3	2	5	53	46	26	2	
Total number of uses for each meaning	835	120				3	2						
Percentages	87	12.5				.3	.2						
Total of subclasses													
Total of class	960							132					
Percentages	25.8							3					

[1] The letters F (figurational), D (depictive), A (abstract), and S (symbolic), distinguish the perceptions according to the kind of meaning or reference which they bear (cf., p. 548, inf.).

TABLE I—*Continued*

Type of process	SENSATIONAL—*Continued*																					
Class	KINAESTHETIC																					
Subclass	MUSCULAR																			STRAIN		
	General					Chest	Hand	Head		Neck	Face	Ocular			Verbal				Eyes and Head			
Meaning of complex																						
Temporal phases	1	2	3	4	5	2	5	2	3	3	2	1	2	3	1	2	3	4	1	2	3	4
Tot. No. of Rec. of all Obs	15	300	56	43	60	3	1	70	2	2	3	37	116	25	13	202	127	6	13	150	1	79
Tot. No. uses for each meaning																						
Percentages																						
Total of subclass	474					3	1	72		2	3	178			348				243			
Total of class	1324																					
Percentages	36																					

TABLE I—*Concluded*

Type of Process	IMAGINAL																										
Class	VISUAL														AUDITORY			KINAESTHETIC								TACTUAL		
Subclass																		General	Verbal	Auditory-Verbal							
Meaning of complex[1]	F			D				A		S																	
Temporal phases	2	3	4	1	2	3	4	2	3	2	3	2	3	4	3			1	2	3	4	2	3	4			
Tot. No. of Rec. of all Obs	205	290	15	2	113	287	44	7	11	11	8	3	18	1	3			24	124	88	17	3	18	1			
Tot. No. of uses for each meaning	510			446				18		19																	
Percentages	51			45				2		2																	
Total of subclasses																		3	3	253							
Total of class	993														22			259							22		
P rcentages	27														.6			7							.6		

[1] The letters F (figurational), D (depictive), A (abstract), and S (symbolic), distinguish the perceptions according to the kind of meaning or reference which they bear (cf. p. 548, inf.)

TABLE II

Group	ORGANIZATION	Fre-Quency	Total for group	Percent-age
I	VS_F >General Kinaesthesis >VI_F	75		
	VS_F >General Kinaesthesis >VI_D	68		
	VS_F >Strain Sensations >VI_F >General Kinaesthesis	24		
	VS_F >Ocular Kinaesthesis >Kinaesthesis, General and Verbal >VI_F >VI_D	18		
	VS_F >Strain Sensations >$VI_F VI_D$ >Verbal Kinaesthesis >Strain Sensations >General Kinaesthesis	79	264	58
II	VS_F >Auditory-Verbal Images	28		
	VS_F >Auditory-Verbal Images >VI_F	23		
	VS_F >$VI_F VI_D$ >Auditory-Verbal Images	22		
	VS_F >$VI_F \begin{Bmatrix} VI_D \\ VI_D \\ VI_D \end{Bmatrix} /$ Auditory-Verbal Images	20	93	20
III	VS_F >Kinaesthesis >VS_D (Head, Eyes, General, Verbal)	46	46	10
IV	VS_F >VI_F	20		
	VS_F >VI_F >VI_D	18	38	8
V	VS_F >VS^D >General Kinaesthesis (Empathy)	19	19	4
	Total		460	100

by special, localized kinaesthesis, such as ocular and verbal. The visual imagery involved differs as to cognitive elaboration. It may be simply the sustained meaning carried over from the corresponding sensational phase and representing a 'nonsense' figure ('figurational') or it may be imagery with derived and extended meaning depicting some definite 'sense' object ('depictive').

2. Group II represents formations of visual sensations and visual and auditory-verbal imagery. The greatest difference among the four patterns is one of complexity with respect to the number of processes; the second may be considered as a greater elaboration of the first, in that the second terminated with a visual reproduction of the figure, which the first perception lacked. The remaining two formations are modifications of the second in respect to temporal sequence.

3. Group III is composed of but one type of integration. It is distinctively set off from the other groups by the fact that the object itself—as carried by visual sensations—changes from being apprehended as a mere irregular figure to one possessing a high degree of meaning. .

4. Group IV is characterized by its absence of kinaesthetic and organic processes. Introspection revealed nothing but visual materials, sensational and imaginal. The second formation differs from the first in degree of meaning, the first never acquiring any more significance than that of an irregular, black figure. The temporal sequence is identical, with the exception that the second expanded into a third phase, in which derived meaning appeared attached to visual imagery.

5. Group V bears a strong resemblance to Group III with respect both to composition and to the function of some of the component processes. But there are also wide differences between the two groups as regards, first, the function of other processes and, secondly, the temporal course of the perception. First, as to similarities, the complexes of both groups are composed of visual and kinaesthetic sensations. Furthermore, the sensations of both groups, which were directly evoked, bear not only the meagre meaning of an irregular figure, but also acquire other significance. As to differences, first, in regard to function, the kinaesthetic factors serve two distinct purposes, that of effort or intent to seek meaning in the formations of Group III, and that of empathic interpretation in those of Group V. Secondly, there is a variation in temporal sequence. The visual processes bearing the derived meaning came after the kinaesthesis (effort) in the combinations of Group III, but accompanied the empathic kinaesthesis in those of Group V.

The groupings of these various perceptual formations may be determined not only upon the basis of similarity of combinations of processes by all observers, but also upon the basis of typical integrative patterns for individuals. Group I is characteristic of all observers (C, 5%; Ra, 20%; Ru, 50%; S, 25%; V, 6%); Group IV, of three, Ru, (6%), S (6%), and V (4%); Group V of three, C (10%), Ra (27%), and S (8%); Group II, of two, C (11%) and V (24%); Group III, of one, S (33%). We may further say that the type of perceptual pattern included in Group I is especially characteristic of Ru; that of Group II, of V; of Group III, of S; of Group V, of Ra; while observer C displays a high frequency in both Groups II and V.

If the integrations should be combined with respect to functional properties, the first two groups would be closely related. While the processes of all but the first phase differ widely, first as to type (those of the first group being sensational, those of the second imaginal), and secondly, as to localization (those of the first being general, those of the second, special), nevertheless, the processes serve similar functions within the perceptions. Both the kinaesthetic sensations and the auditory-verbal images perform the function either of *bearing meaning* or of self-instruction to *seek meaning* in the figure. The difference in process represents merely individual variations in interpretation or significance.

An examination of Table II reveals the following facts:

1. Visual sensations alone, for the greater part, compose the first phase of the perception.
2. Kinaesthesis, general and special, is an important component within most perceptual complexes and usually occurs in the second phase.
3. With very few exceptions, imagery, especially visual, occurs in every perception, but its appearance is, for the greater part, comparatively late in the temporal course.

From Table I we see that introspection revealed seventeen different kinds of process within the perceptual complexes. Further investigation discloses the fact that these processes were distributed over no less than five temporal phases within the perceptions. Table III represents the distribution of the various processes in all the 882 perceptions with respect to kind and function, in the five temporal phases. The processes are arranged in each phase according to their order of frequency, from the greatest to the least.

Thus, in the first temporal phase of the perception, visual sensations, bearing the mere apprehension of the black figure, were the most frequent (835); the visual complex which carried a depictive significance, second in frequency (44); and so on. But parallel processes in the various phases are

TABLE III
TEMPORAL PHASES

Order	1	2	3	4	5
1	VS_F	General Kinaesthesis	VI_F	Strain Sensations	General Kinaesthesis
2	VS_D	VI_F	VI_D	VI_D	Organic Sensations
3	Ocular Kinaesthesis	Verbal Kinaesthesis	Verbal Kinaesthesis	General Kinaesthesis	Hand Kinaesthesis
4	Auditory-Verbal Imagery	Strain Sensations	Auditory-Verbal Imagery	Organic Sensations	
5	General Kinaesthesis	Auditory-Verbal Imagery	General Kinaesthesis	Auditory-Verbal Imagery	
6	Verbal Kinaesthesis Strain Sensations	Ocular Kinaesthesis	VS_D	VI_F	
7	Organic Sensations	VI_D	Organic Sensations	Verbal Kinaesthesis	
8	VS_A	Head Kinaesthesis	Ocular Kinaesthesis	VS_D Auditory Imagery Tactual Imagery	
9	VI_D	Organic Sensations	Auditory Imagery Tactual Imagery		
10		VS_D	VI_A		
11		VI_S	VI_S		
12		VI_A	General Kinaesthetic Imagery Verbal Kinaesthetic Imagery		
13		Facial Kinaesthesis Chest Kinaesthesis Auditory Imagery Tactual Imagery	Head Kinaesthesis Neck Kinaesthesis		
14		VS_S	Strain Sensations		

not to be interpreted as of approximately equal frequency; *e. g.,* the occurrences of general kinaesthesis (300) in the second phases are not so numerous as those of VS_F, in the first. The table simply indicates the relative importance of each kind of mental phenomenon in each temporal division of the total complex. While bodily kinaesthesis occurs in each phase, it may, nevertheless, be said to be most characteristic of the second, *i. e.,* if it appears anywhere within a perceptual integration, it is more apt to be subsequent to the processes directly evoked. Table III further shows that the accessory processes in every phase but the first are of much more significance to the meaning of the perception than the concomitant, directly initiated processes. For example, while the visual sensations may in the second, third, and even the fourth phase, possess significance other than merely that of a black area on white, nevertheless various other complexes have precedence in frequency. Of course, with other materials, the perceptual value of the first phase might be greatly emphasized.

Perceptions, then, which arise from the observation of ink-blots, are composed of three fundamentally different kinds of processes; (1) those directly evoked, (2) those which are related to organic movement, and (3) imaginal materials derived from various sources. These have all been shown to be of primary importance to the perception, each discharging its own peculiar service or supplementing that of other processes.

In this investigation, the visual complexes were found to perform four various functions. First, the object was apprehended, either directly of indirectly, as being merely a black area on white.

"The visual complex simply meant an irregular figure of some sort." (Ru)

This type of meaning we shall designate as *figurational* (VS_F or VI_F). Secondly, the same complexes were involved in the ascription of other meaning, in depicting the figure as some particular object (VS_D or VI_D), *depictive* function.

"The figure meant a bull-moose, horns and all very definite." (S)

Thirdly, the visual processes did not depict a particular object such as a particular hill, tree, or house, but they bore the meaning of a concept, as of centipede or of quadruped or of triangularity.

"In the perception, the object immediately became a general representation of such an animal as a centipede." (S)

We have designated this function as *abstract* (VS_A and

VIA). Fourthly, the figure might be apprehended, not as some definite and particular object, but as a representation of an object, as a symbol (VSs and VIs), *symbolic function.*

"The visual and auditory imagery carried the meaning that this was a symbolic representation of a waterfall." (Ru).

Reference to Tables I and II will make it clear that in the perception of figures which possess no, or only slight meaning the visual processes more frequently display figurational and depictive functions than abstract and symbolic. While the figurational and depictive functions, taken together, occur with the same frequency in the sensational (955) as in the imaginal (956) processes, yet there is a decided difference when considered separately. As many as 835 of the visual sensation-groups were figurational and but 120 depictive, while in the case of imagery, 510 were figurational and 446 depictive, thus indicating that imagery is here of more importance than sensations in giving derived significance.

Again, in the case of abstract and symbolic functions, there is a greater frequency in imagery than in sensations. Thus, the primary function of the directly initiated processes becomes one of bare apprehension of object, while that of imaginal materials is to elaborate upon the meaning.

Whatever primary meaning the perception possessed usually appeared with the visual complexes. In this sense the perceptions are correctly called 'visual.' The kinaesthetic and organic processes, sensational and imaginal, did little at first to add to or to modify it. Their chief function in the first phase was (1) to bear effort or intent to find-significance-in-the-figure, or (2) to question the fitness of meaning ascribed by other processes. Thus, they were accessory to the visual complexes rather than directly assimilated to them. Group V of Table II, however, is an exception to this kind of function. In this mode of integration the empathic kinaesthesis substantiated the meaning attached to the visual sensations, thus actually displaying a depictive function, although the interpretative function is still evident.

The auditory and tactual imagery perform a service similar to that of the organic and kinaesthetic processes, *i. e.,* they carry self-instructions either to seek meaning in the figure or to determine the appropriateness of significance. They primarily represent individual differences in the observers in the interpretation of the figures. Auditory and auditory-verbal imagery in the cases of C and V and tactual imagery in the case of Ra discharge the same office as kinaesthetic

processes do for other observers and frequently also for these same observers.

Summarizing our experimental results thus far presented, we may say that perceptions have a tendency toward certain integral formations which possess peculiarities due to individual differences but which, nevertheless, conform in general to common patterns. Within these configurations, the various processes follow a temporal course quite definitely determined; the directly evoked sensations showing a marked precedence over all others in the first phase, the indirectly initiated sensational complexes composing the greater part of the second, and imaginal processes holding predominance in the third. Again, the various processes which compose the perception display some specificity of function; the visual processes bear the primary meaning, while those connected with organic movement together with the imaginal components both interpret and extend whatever significance the figure may derive and enforce the intent to enrich the perceptual meaning.

B. The Elaboration of Perceptual Meaning.

Problem and method. Typical integrations having been established for perceptions of figures with very slight or nominal significance, it became the primary task of this immediate part of the investigation to determine whether an essential change occurs in perception when material with a slightly higher degree of significance is used. For this purpose, we made use of hieroglyphics and cubists' drawings. A series of 50 cards was made, bearing objects which suggested various degrees of meaning. The following illustrations are typical of the series.

These cards were exposed as the ink blots were for ½ sec. to the observers, C, Ra, and Ru. The instructions were as follows:

"Two seconds after a 'ready' signal, a figure will be briefly exposed. A distraction will be given at the end of two seconds. Upon distraction, report at once whether the figure is wholly devoid of significance. Then give full introspections."

Results. No difference in composition was discovered between the perception of inkblots with minimal meaning and the perception of figures possessing a greater degree of significance.

The complexes revealed types of integration similar to those of the first set. But, although there is no difference on the

side of composition, there is a marked change in the function of the different processes. Whereas, in the perceptions reported under the first experiment, many processes bore the general function of seeking and interpreting meaning, the same processes serve other purposes as well when the object becomes more 'meaningful.' In this series of investigations we have distinguished three kinds, interpretative, appreciative, and orientating.

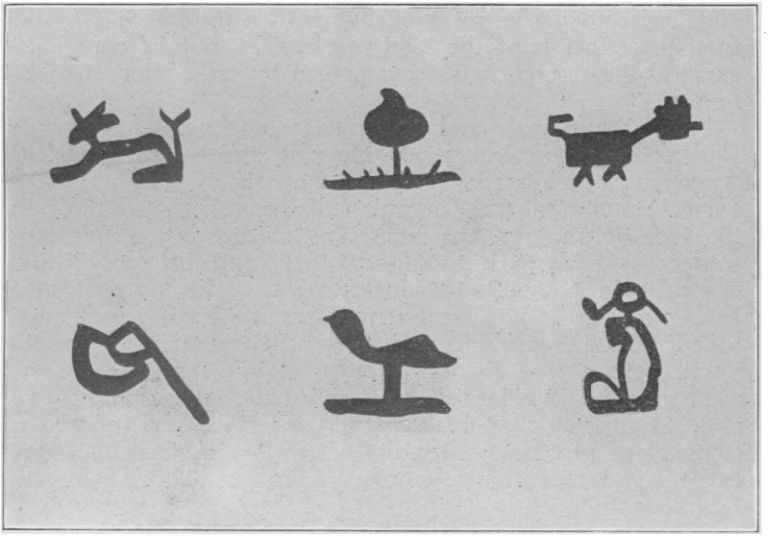


FIG. 1

The interpretative function is of the same type as we found prevalent in the perceptions of the first experiment. It is the effort or intent on the part of the observer to read meaning into the object. The following excerpts will illustrate its application as related to various types and classes of mental phenomena:

"I felt myself (general empathic kinaesthesis) standing erect and rigid, and then the meaning 'grass' came." (C)

"There was a very clear auditory image of the word 'bowl' and with it a general kinaesthetic set which meant the realization that the object was not like a bowl. Kinaesthesis of the hands and tactual imagery gave 'roundness' to the top." (C)

"There was much organic disturbance, which meant that the figure was complex, that it was a problem which I must solve." (Ru)

"Visual images assimilated with visual sensations gave the meaning of solidity." (Ra)

These illustrations not only indicate a similarity to the interpretative function of the processes in Experiment 1, but also a difference. In Experiment 1 we found that the interpretation was of the desiring, seeking, searching type without any satisfactory fulfillment, *i. e.,* if derived meanings did occur as a result of the search, they were usually rejected or at least not wholly accepted. In Experiment 2 we find this same intent and desire to derive meaning but with a difference. In the first, the effort is of the kind involved in 'puzzle' consciousness; in the second, it is accompanied by satisfactory realization.

Both sensational and imaginal components commonly functionate as explorers for meaning in the object. The sensations which serve in this manner have both a limited (visual) and a general (organic and kinaesthetic) origin. In the case of imagery, the materials are drawn from various sources, specific (as visual, auditory, and olfactory) and general (as tactual and kinaesthetic). The *interpretative* function, then, is not peculiar to a particular class of mental processes, although effort itself is directly connected with kinaesthesis.

The second function we have called the *appreciative* function, a term employed to designate the service of a process or complex of processes when the figure is valued, *i. e.,* where it gives rise to pleasure, enjoyment, or aesthetic sentiments. Examples follow.

"There was a general, kinaesthetic and organic complex, meaning amusement because the dog was so fantastic and so incongruous." (C)

"There were numerous visual images of scalps and skins and of tortoise-shell combs of variegated colors. With this was a pleasant organic complex. The total complex signified the richness of meaning of the object." (Ru).

"There was a background of visual imagery, associations from the history of man, carrying an appreciation of the feeling of unity with man." (Ra).

As regards the interpretative function, we found that any kind of mental process might fill such an office, whereas only the indirectly evoked sensations (organic and kinaesthetic) and imaginal processes carry the appreciative function and, moreover, that the imaginal processes which here functionate as appreciation are limited to the two classes, visual and kinaesthetic-verbal. This would seem to indicate either (1) that the meaning of these perceptions was not yet complex or

evident enough to involve many processes in appreciation, but still demanded much interpretation, or (2) that fewer kinds of process actually perform this valuating or estimating service.

The *orientating* function is a third kind of performance distinct from either the interpretative or the appreciative. There is no effort or attempt involved to attach purport to the object, nor is there any valuation of such meaning as may be present, but the processes functionate in placing or localizing in time or space the object with reference either to the observer or to other objects.

"There were some organic processes in the background, allied with kinaesthetic processes which gave the object position." (Ru)

"There was confused visual imagery referring to sketching classes where they had drawings of friezes, of Egyptian designs, and of Greek and Roman figures." (C)

"There came an auditory image of the word 'curlique' which was accompanied by auditory imagery referring it back to other diagrams meaning the same thing." (Ru)

"This reference to books on archeology came in terms of visual imagery of pictures and kinaesthetic-tactual imagery of the feel of the page with print and pictures." (Ra)

The orientating function, then, is characteristic of organic and kinaesthetic sensations and of imaginal processes from various sources. Of the images derived from definite sources, we find visual and auditory; of those with a diffuse origin, tactual and kinaesthetic.

Although three kinds of functions may be assigned to the various processes, nevertheless, as far as our results indicate, we cannot say that all are of equal importance in giving meaning to the perception. In Table IV the total number of processes has been recorded under each function with respect to the capacity of each for carrying these three kinds of significance. The interpretative, appreciative, and orientating functions are indicated by I, A, and O, respectively. The symbols + and — indicate whether or not processes discharging particular functions, added to the significance of the perceptions,—a significance, which had already been derived, *e. g.,* the meaning 'horn' is already attached to a visual complex, when an auditory image of the word 'horn' subsequently occurs. The latter supplies nothing new to the context and is therefore set down as —.

TABLE IV

Observers		No. of + and — Processes								Total No. of Processes			
		I		A		O		A and O		I	A	O	A and O
		+	—	+	—	+	—	+	—				
C	Totals.....	152	27	21	0	42	17	63	17	179	21	59	80
Ra		77	18	8	1	15	9	23	10	95	9	24	33
Ru		96	66	35	1	57	35	92	36	162	36	92	128
C	Percentages....	59	10	8	0	16	7	24	7	69	8	23	31
Ra		60	14	6	0.8	12	7	18	7.8	74	6.8	19	25.8
Ru		33	23	12	0.3	20	12	32	12.3	56	12.3	32	44.3
	Grand totals...	325	111	64	2	114	61	178	63	436	66	175	241
	Percentages....	48	16	9	0.3	17	9	26	9.3	64	9.3	26	35.3

From an inspection of this Table we may conclude as follows:—

1. In perceptions possessing a moderate degree of meaning, processes which serve as 'interpretation' are approximately twice as frequent (436) as processes which valuate and localize (241) the object. This observation points to the fact that the meaning was not so evident but that most of the components in the perceptual process stood for effort or intent to attach significance to the figure.

2. Every kind of component in the perception shows a greater tendency to be positive rather than negative to the meaning, *i. e.*, in every instance, the processes which contributed to the meaning greatly outnumber those which failed to enlarge the significance. All of the 'appreciative' processes, with two exceptions, enriched meaning. The phenomena which localized the object, however, made no contribution to the meaning about half as frequently as they added thereto. Although we have said that processes add or fail to add meaning, we cannot say how much each process contributes to the significance of each perception. For example,—to take a typical illustration,—we perceive an irregular figure which assumes the derived meaning of 'cannon' by virtue of the visual sensations themselves. Then appears a visual image of this spot, still possessing the meaning 'cannon.' In this instance, it is evident that the sensations were of much more importance to the meaning than the images, and that although there were two types of process we cannot say that each contributed one-half the meaning. Meaning itself is 'richer,' 'poorer,' 'more or less elaborated;' but it is not divisible into fractional parts.

3. After the interpretative processes have run their course, other processes have a greater tendency to serve in placing the object in space and time than for appreciation. There are approximately three times as many 'O' as 'A' processes.

4. From the general results of Table IV, there seems to be a temporal evolution of the various functions of process from perceptions with minimal meaning to those with considerable meaning. When meaning is minimal, the processes serve for bearing and interpreting it. Then as meaning becomes more elaborate, the processes acquire other functions, first that of localization, and secondly that of appreciation.

Table IV also reveals some individual differences with respect to the functional aspect of mental processes.

1. The 'I' processes vary from 56% for Ru to 74% for Ra. (This difference should be considered in connection with Table V, below.)

2. Ru shows a higher ratio between his 'O' and 'A' processes and his 'I' processes than either C or Ra.
3. There are also marked differences with respect to the relation of the processes to the meaning. Ru has approximately as many 'A' and 'O' as 'I' processes which add to the meaning, while C and Ra show a predominance of positive 'I' processes. In Ru's perceptions, also the 'I,' 'A,' and 'O' processes which do not add to the meaning have a lower ratio to those that are positive than is true in the case either of C or of Ra.

We have seen that there is a tendency for the 'A' and 'O' processes to increase in frequency as meaning becomes more elaborate. In our next table (V) this relationship of process to degree of meaning becomes more clearly apparent. Here the meaning of the object has been designated as 'none,' if it possessed no significance other than that of a black area on white. It will be recalled that this series was purposely so made as to bear varying degrees of suggestion. 'Slight' indicates that there was present a low degree of meaning, which was usually indicated by hesitation on the part of the observer to accept it, or by lack of details, or by the predominant function of all the processes involved. 'Considerable' indicates that the object was rich in detail and setting.

In the case of 'no' meaning the results quoted in Table V show that but few processes with the orientating function occurred and none of the appreciative type. But in perceptions, which possess 'slight' meaning, there is a greater frequency both of the 'A' and 'O' kinds of process with a greater prevalence of the 'O' type. The same is true of complexes listed under the third degree of meaning. This further substantiates the statement made above that as meaning develops more and more the accessory components of the perception acquire new functions, namely, the orientating and the appreciative. The processes discharging these services also vary directly in frequency with the significance. Table V further shows that, if judged by frequency, the same classes of process assume the orientating function before the appreciative, *i. e.,* in the instances of 'no' meaning, there were but few 'O' processes, and no 'A' processes, while in the other instances, the 'O' processes always exceed the 'A's'. This fact illuminates the reason for Ru's displaying such a high frequency of 'A' and 'O' processes (Table IV). From Table V, we see that Ru reported no perception under the 'none' degree of meaning.

These facts accord with those of the first series of experiments, where, with the exception of the integrations listed under Group V of Table II, all accessory processes presented

TABLE V

Observers		Meaning											
		None				Slight				Considerable			
		I	A	O	A and O	I	A	O	A and O	I	A	O	A and O
C Ra Ru	Totals.....	12 7 0	0 0 0	2 3 0	2 3 0	58 26 48	5 2 8	18 7 27	23 9 35	109 62 114	16 7 28	39 14 65	55 21 93
C Ra Ru	Percentages	5 5 0	0 0 0	.8 2 0	.8 2 0	22 20 17	2 2 3	7 5 9	9 7 12	42 49 39	6 5 10	15 11 22	21 16 32
	Grand totals	19	0	5	5	132	15	52	67	285	51	118	169
	Percentages	3	0	.7	.7	19	2	8	10	41	8	18	26

clearly the interpretative function, since the figures used in those experiments possessed just as little meaning as possible. In the case of perceptions which involved empathic kinaesthesis, which was mostly interpretative, but with a suggestion of the localizing function, the objects were probably of the same degree of meaning for the various observers as those judged as having "no" meaning in the second series of 'object' cards.

The following general conclusions may be drawn from the results of Experiment 2:

1. The accessory processes, kinaesthetic and organic sensations and various imaginal components, acquire functions other than the interpretative, as meaning grows more elaborate. In this experiment these new services have been found to be appreciative and orientating.
2. The accessory processes which perform the appreciative and orientating functions increase in frequency directly with the degree of meaning.
3. The various functions of mental processes appear in a definite order, in perceptions of varying degrees of meaning; (1) interpretative, (2) orientating, and (3) appreciative.

C. Relation of Attention to Perception.

Up to this point our experimental results have shown us, first, that perceptions fall into typical integrations, secondly, that perceptions present various degrees of cognitive and appreciate elaboration, and thirdly, that the elaboration of significance is relatively independent of the particular kind of mental processes involved. But our analytic problem is not yet complete. We must not neglect the state and the configuration of the total bit of mind in which the perceptual complex is embedded. This is the problem of the relation of attention to perception. We approach it by taking an inventory of all the processes, at their several degrees of clearness, which lie both within and without the particular constellation which we have undertaken to study.

1. *Preliminary series.*

Problem and method. In order to train our subjects to observe these degrees of clearness or vividness, two series of preliminary experiments with distraction were performed. In the first a series of nonsense-syllables was exposed, approximately one each second, which was to be memorized by the observer. Some time during the learning-period a distraction was offered by drawing a pattern upon the back of O's left hand with the blunt end of a pen shaft. At a signal "now,"

O introspected for that instant, estimating the various processes according to nine degrees[69] of clearness.

The second series of experiments consisted of a double task. O was given one of the cancellation test-sheets and asked to mark all 'a's'. While he was thus engaged, simple arithmetical sums and multiplications were orally given and their solution demanded. At a signal 'now' full introspections were reported with respect to the clearness of the processes, which were present just at the signal 'now.' The experimenter in both series always attempted to give the signal 'now' while the observers were distracted either by the pattern or by the computation.

The instructions for the first series, where C, De, Ra, and Ru observed, read as follows:

"A 'ready' signal will be given. Two seconds later, the first of a series of nonsense-syllables will be exposed. Learn the series. During the learning-period, a distraction will be given by drawing a pattern on the back of your hand. At a signal 'now,' give an introspective account of the degrees of clearness of all processes, present at the signal 'now.' The degrees of clearness are to be judged in the following terms:

maximally clear	1
very clear	2
clear	3
fairly clear	4
fair	5
fairly vague	6
vague	7
very vague	8
obscure	9"

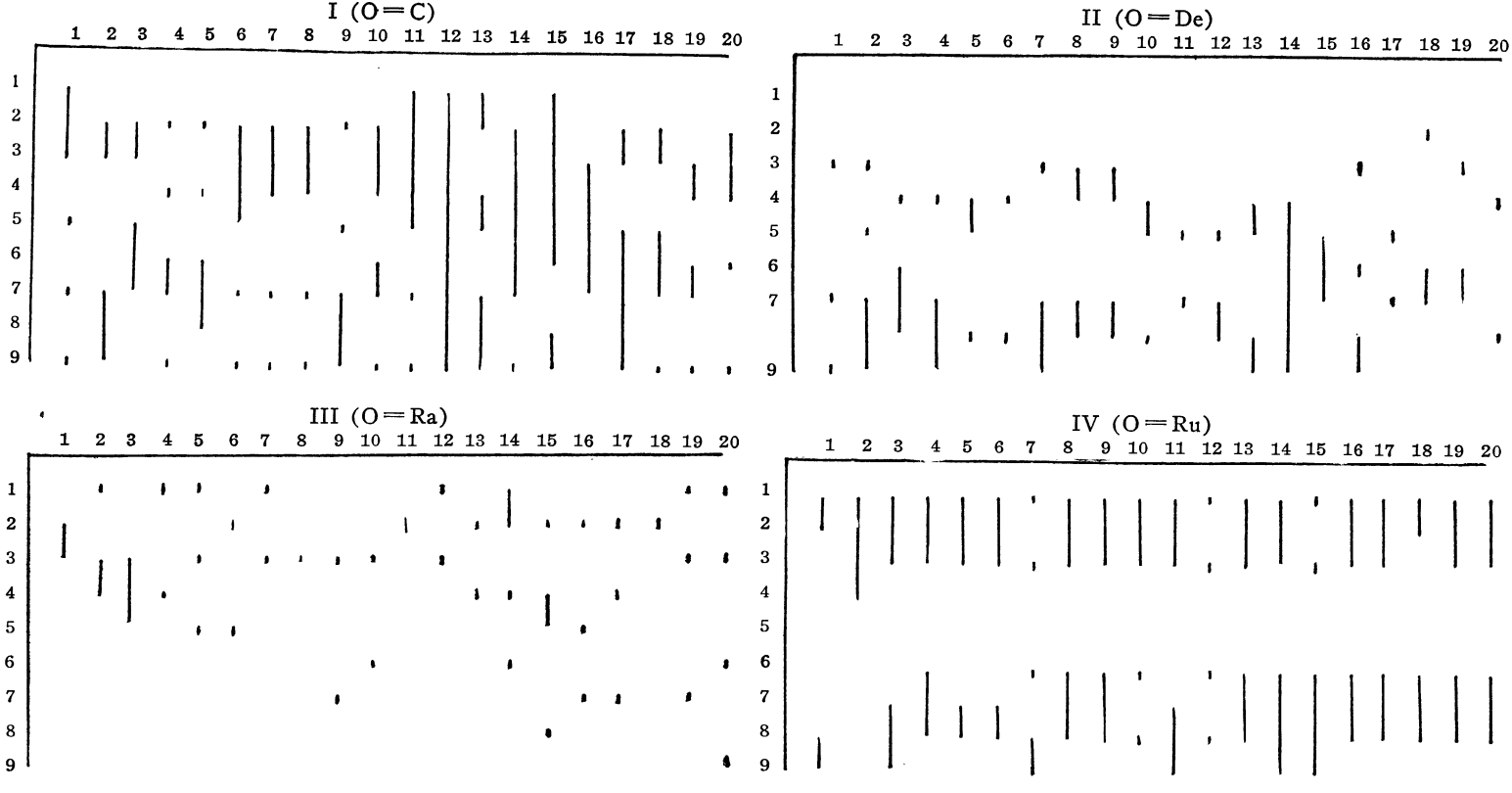
Instructions for the second series were:

"A 'ready' signal will be given. Two seconds later a signal 'start,' at which begin crossing out the "a's" on the sheet before you. During this process, simple arithmetical additions and multiplications will be given for about two seconds. At a signal 'now,' give an introspective account of the degrees of clearness of all the processes present just at the signal 'now.' The degrees of clearness are to be judged in the following terms; [the same 9 degrees were used as for the first series]."

Results. The two preliminary series of experiments resulted not only in training the O's in the use of the degrees of clearness, but also determined the type of consciousness of each observer, whether it was of the foreground-background type or multilevel. Graphs I-IV, showing the results for nonsense-syllables, illustrate individual differences.

[69]We employed the same 9 values for determining the degrees of attention as were used by Geissler, (The measurement of attention, *Am. J. of Psychol.*, 1909, xx, 502) and Dallenbach, (*ibid.*, 1913, xxiv, 468).

DEGREES OF CLEARNESS



In the graphs the trials are ordered on the abscissae, the degrees of clearness on the ordinates. Adjoining degrees are connected by solid vertical lines.

The diagrams then suggest that C and Ra and possibly also De, represent multilevel types of mind. The data for the double task series indicate results similar to those for the first series. Both are included in Table VI. The symbols 'N-S' and 'A' are employed to represent the nonsense-syllables and the cancellation sheet, respectively. It may be said in general that the observers exhibit a similar distribution of processes among the nine degrees of clearness with the exception of Ru, whose two-level division reduces the numbers for the medium and the very lowest degrees. And again, when Ru's estimations of vividness are divided into three large groups (for the sake of inspection), there is practically an equal distribution for each group. Ra, while he grouped most processes in the middle level for the 'N-S' series, nevertheless exhibits a greater frequency among the maximally clear than among the obscure processes. In his 'A' series, very clear processes are more frequent than those which are moderately clear, with still fewer obscure components. The general tendency for all observers seems to indicate that most factors within the perceptual complexes are moderately clear, fewer are obscure, and a still smaller number maximally clear.

2. *Main series.*

Problem and Method. The primary task of this investigation was to estimate the bearing of clearness upon perception. To this end, the original series of inkblots (see Experiment 1) was again used. As before, the observer gave full introspective reports concerning the perception, but, in addition, the clearness of each process was given on the scale of 1-9 according to the method employed with nonsense-syllables and the literal tests of our preliminaries.

The instructions read:

"Signal, exposure and distraction-stimulus will be given as before. During the whole period of observation take the perception quite passively; do not force an 'object.' Give full introspections, indicating perceptions and other meanings in parallel wth the description of processes. The introspections should include (a) analysis of complexes, (b) the sequence and order of groups, and (c) the area of maximal clearness. The degrees of clearness are to be judged in the following terms: [See instructions for preliminary series]."

The time of exposure was ½ sec., but introspection covered a period of 2 sec. C, De, Ra, and Ru observed.

TABLE VI

Clearness values	9 Degrees														3 Degrees											
	C				De				Ra				Ru				C				De				Ra				Ru			
	N-S		A		N-S		A		N-S		A		N-S		A		N-S		A		N-S		A		N-S		A		N-S		A	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	5	3	1	.4	0	0	0	0	15	17	17	30	30	18	18	14	23	18	18	9	10	6	0	0	34	40	27	47	55	32	38	30
2	18	14	17	8	10	6	0	0	19	22	10	18	25	15	20	16																
3	18	14	28	13	31	19	9	7	14	16	6	11	28	16	19	15																
4	16	12	37	17	20	12	35	26	10	12	4	7	2	1	0	0	62	48	118	55	98	61	78	58	38	44	21	37	56	33	53	42
5	14	11	27	13	23	14	22	16	8	9	8	14	2	1	14	11																
6	14	11	26	12	24	15	12	9	6	7	3	5	24	14	20	16																
7	19	15	23	10.6	27	17	21	16	10	12	3	5	22	13	17	13																
8	7	5	27	13	19	12	29	22	3	4	2	3	30	18	19	15	45	34	77	36	54	33	56	42	14	16	9	16	59	35	36	28
9	19	15	27	13	8	5	6	4	1	1	4	7	7	4	0	0																

TABLE VII (O = C)

Clearness values....	1			2			3			4			5			6			7			8			9			All values			%			Proc. in 3 phases	%	Type of Proc.	%	Class of Proc.	%
Phases.....	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3								
Processes																																						
Visual.....																																					207	37.3
Sensations.....	4			21	11		27	10		20	6	1	4	4		5	2		4			1		1	2			88	33	2	16	6	.4	123	22	123	22		
Images.....																																			84	15				
Spot.....						1					1	1		1			8	1		7	3	1	5	5		2	7	1	24	18	.2	4	3	43	8				
Associations...						1					3			2	2		2	6		6	9	1	1	5		3		1	17	23	.2	3	4	41	7				
Auditory images....					1	3		8	10		7	5		7	1		7	2	2	3	1		5	3		1		2	39	25	.4	7	5	66	12	66	12	66	12
Cutaneous images..																																					2	.4	2	.4
Pain.....																								2									4	2	.4				
Organic sensations..														1			1					1	1	3		2	2	2	4	5	.4	.7	.9	11	2	11	2	11	2
Kinaesthesis.....																																					268	48.3
Sensations..																																			231	42		
Muscular:																																						
General.....				2					3	3				6	3	9	6	1	27	10	3	22	18	13	18	18	9	81	58	32	15	10	6	171	31				
Legs.....																1												1			.2			1	.2				
Arms.....										1		1				1	2		4	5	1	1	6	1	2	1	2	9	14	5	1	2	.9	28	5				
Face.....												1			1									3						5			.9	5	.9				
Eye.....																							1		1			1	1		.2	.2		2	.4				
Throat.....																			1	2		1		2				2	2	2	.4	.4	.4	6	1				
Strain:																																						
Neck.....				1								1				1		1	2				1					4	1	2	.7	.2	.4	7	1.3				
Face.....																						1						1			.2			1	.2				
Eye.....				1								1				1		1	3				1					5	1	2	.9	.2	.4	8	1.4				
Throat.....											1										1								1	1		.2	.2	2	.4				
Images.....																																			37	6.6				
General.....																				1									2			.4		2	.4				
Aud.-verbal....		2	1		6	6		6	6		4				2						1						1		18	17		3	3	35	6.3				
Clrns. vals. by phases	4	2	1	25	18	11	27	24	19	24	22	11	4	21	9	19	28	12	43	34	19	29	39	38	23	27	21	198	215	141								
All phases.....	7			54			70			57			34			59			96			106			71			554										
Percentages.....	1			10			13			10			6			11			17			19			13			36	39	25								
Values in 3 degrees.	61						220												273																				
Percentages.....	11						40												49																				

TABLE VIII (O = De)

Clearness values....	1			2			3			4			5			6			7			8			9			All Values			%			Proc. in 3 phases	%	Type of Proc.	%	Class of Proc.	%
Phases.....	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3						
Processes																																							
Visual.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	101	64
Sensations.....	--	--	--	--	--	--	10	--	--	11	1	--	20	--	--	11	--	--	5	--	--	2	--	--	1	--	--	60	1	--	38	.6	--	61	39	61	39	--	--
Images.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	38	24	--	--
Spot.....	--	--	--	--	--	--	--	--	1	--	2	--	--	2	2	--	3	1	--	3	2	4	9	4	1	4	2	5	23	12	4	15	7	38	24	--	--	--	--
Kinaesthesis.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	57	36
Sensations.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	4	--	--
General.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	1	--	--	--	--	3	1	--	2	.6	--	4	3	--	--	--	--
Arms.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1	--	--	.6'	--	1	.6	--	--	--	--
Images.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	52	33	--	--
Verbal.....	--	--	--	1	1	1	4	2	1	7	4	--	6	1	1	7	--	1	5	1	--	3	4	1	--	--	--	33	13	5	21	8	4	51	32	--	--	--	--
General.....	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	1	--	--	.6	--	1	.6	--	--	--	--
Clrns. vals. by phases	--	--	--	1	1	1	14	2	2	18	7	--	26	3	3	18	3	2	10	5	2	12	15	5	2	4	2	101	40	17									
All phases.....				3			18			25			32			23			17			32			8			158											
Percentages.....				2			11			16			20			15			11			20			5			64	25	11									
Values in 3 degrees.			3						98												57																	
Percentages.....			2						62												36																	

TABLE IX (O = Ra)

Clearness values....	1			2			3			4			5			6			7			8			9			All Values			%			Proc. in 3 phases	%	Type of Proc.	%	Class of Proc.	%
Phases.....	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3								
Processes																																						
Visual.....																																					134	59
Sensations.....	16	1		20	8	1	6	6	1	6	6		5	7	3	3	3	2	3	2		1	1	1				60	34	8	26	15	4	102	45	102	45		
Images.....																																				32	14		
Spot.....					2			2							1		1			1									6	1		3	4	7	3				
Associations...		1		2	6		4	2	3		1			1			2	1		1	1						6	14	5	3	6	2	25	11				
Auditory Images...					1			1		1							1											1	3		.4	1		4	2	4	2	4	2
Cutaneous images..																																					19	8
Pressure.....	2	1		4	4				1	3	2						2											9	9	1	4	4	.4	19	8	19	8		
Organic sensations..		1			1			1			2		1	1														1	6		.4	3		7	3	7	3	7	3
Kinaesthesis.....																																					64	28
Sensations.....																																				24	10		
Muscular:																																						
General....				2	2			1									1		2			1						5	4		2	2		9	4				
Shoulders ...	1																1											1	1		.4	.4		2	.8				
Arm.....	1						2							1														3	1		1	.4		4	2				
Head.....	1				1												1		1									2	2		.8	.8		4	2				
Eye.....								1		2																		2	1		.8	.4		3	1				
Forehead....								1								1												1	1		.4	.4		2	.8				
Images.....																																				40	18		
General.....	3	2		5	3	1	3	2	1	2	2		2			1	3		1	1					1			18	13	2	8	6	.8	33	14				
Hand.....				1	2					1	1			1														2	4		.8	2		6	3				
Aud.-verbal....				1																								1			.4			1	.4				
Clrns. vals. by phases	24	6		35	30	2	15	16	6	15	14		8	11	4	5	15	3	7	5	1	2	1	1	1			112	99	17									
All phases.....	30			67			38			29			23			23			13			4			1			228											
Percentages.....	13			29			16.6			13			10			10			6			2			.4			49	43	8									
Values in 3 degrees .	97						113												18																				
Percentages.....	42						50												8																				

TABLE X (O = Ru)

Clearness values....	1			2			3			4			5			6			7			8			9			All Values			%			Proc. in 3 phases	%	Type of Proc.	%	Class of Proc.	%
Phases.....	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3						
Processes																																							
Visual.....																																					261	36
Sensations.....	77	20	3	9	8	1	2	5	1																			88	33	5	12	4	.7	126	17	126	17		
Images.....																																				135	19		
Spot.....		1		3	7	1	3	3	2										1									6	11	4	.8	2	.5	21	3				
Associations..		10	13	23	39	7	6	7	5							1	3											29	57	28	4	8	4	114	16				
Organic sensations..							2	5	3				30	29	12	8	9	4	13	3	2	5	6	1				58	52	22	8	7	3	132	18	132	18	132	18
Kinaesthesis.....																																					338	46
Sensations.....																																				288	39		
Muscular:																																							
General.....								2					1			2	4		4	3		3	2	1				10	11	1	1	2	.1	22	3				
Shoulder.....														2															2			3		2	.3				
Eye.....			1	7	2	2	4	7					2	2	1		2			1	1							14	14	4	2	2	.5	32	4				
Verbal.....				6	9	8	33	37	14					3	2						2		1					39	50	26	5	7	4	115	16				
Strain:																																							
General.....									1				1	1	1				1			1	1	1				3	2	3	.4	.3	.4	8	1				
Head.....				6	7	1	18	6	1	1	2		6	8	3	6	4	3	1	3	3	2	2	1				40	32	12	5	4	2	84	11				
Forehead....					1			1					2	2	1	2	3	1										4	7	2	.5	1	.3	13	2				
Eye.....					1		3	2	2				1	1				1		1								4	5	3	.5	.7	.4	12	2				
Images.....																																				50	7		
Verbal.....	1				2	1	18	17	6				1	2		1							1					21	22	7	3	3	1	50	7				
Clrns. vals. by phases	78	31	17	54	76	21	89	92	35	1	2		44	50	20	19	23	12	20	11	8	11	13	4				316	298	117									
All phases.....	126			151			216			3			114			54			39			28						731											
Percentages.....	17			21			30			.4			16			7			5			4						43	41	16									
Values in 3 degrees .	277						387												67																			
Percentages.....	38						53												9																			

Results. Tables VII-X present a tabulation by observers with respect to kind of process, degree of clearness, and phase of perception. They include only processes relevant to the perception and not those of the total mind.

When the various kinds of process are considered with regard to their frequency in the nine classes, wide individual variations in relative clearness appear; but they largely disappear again when the nine degrees are reduced to three.

For example, we find upon inspection of the Tables that the visual sensory complexes occurred fairly well distributed under the nine values for C and Ra, while they all belonged to Ru's area of maximal clarity, and with few exceptions in the range of moderately clear components for De. And again, with reference to the kinaesthetic complexes, which are common factors for all observers, there is a decided tendency for them to be of very low level in the case of C, but of moderate clearness for all others. The extent of distribution does seem to bear some relation to the predominant type of process, *e. g.,* C, De, and Ra, who reported visual sensations under at least seven of the nine categories, possess a predominance of visual sensations over visual imaginal complexes, while Ru, who reported no visual sensations of less than degree 3, shows a slightly higher percentage of visual imagery than of sensational material. But no fixed relation as regards relative clearness of sensation and image of the kinaesthetic kind can be made out, possibly because these processes are all alike—as some writers contend—sensational in character. Again, no constant relation obtains between the clearness of sensations directly evoked and the frequency and clearness of those indirectly initiated. For example, C, whose visual processes range from 1 to 9 degrees in clearness, reveals a higher percentage of kinaesthesis, while Ru, who reported visual processes only as of the highest degrees, also possesses a much higher percentage (39) of kinaesthetic than of visual sensations (17). Neither is there apparent a direct relationship between the vividness of visual and of kinaesthetic sensations. In C's case, where the visual processes were widely distributed, kinaesthesis showed a tendency to run very low in clearness, whereas in the case of Ru, where the visual processes were concentrated at a high level, the kinaesthetic sensations were distributed, for the greater part, over the middle values. The directly and indirectly initiated sensations then seem to vary independently of each other both as to frequency and to clearness.

If now we consider all degrees of clearness under three large groups, maximally clear, moderately clear, and obscure, a grouping which our preliminary experiments seem to justify, then these wide irregularities in large measure disappear. The difference is revealed in Table XI which brings together the footings of the individual results (in Tables VII-X). The highest frequency (49%) falls within the field of moderate clearness, while the other regions are, in the totals, virtually the same (26% and 25%). All observers agree in the large number of processes of moderate clearness; though they differ

in distribution between the two extremes of clarity and obscurity.

TABLE XI

Obs.		Clearness Values									Totals For All Values		
											Phases		
		1	2	3	4	5	6	7	8	9	1	2	3
C	Totals.....	7	54	70	57	34	59	96	106	71	198	215	141
De		0	3	18	25	32	23	17	32	8	101	40	17
Ra		30	67	38	29	23	23	13	4	1	112	99	17
Ru		126	151	216	3	114	54	39	28	0	316	298	117
C	Percentages....	1	10	13	10	6	11	17	19	13	36	39	25
De		0	2	11	16	20	15	11	20	5	64	25	11
Ra		13	29	16.6	13	10	10	6	2	.4	49	43	8
Ru		17	21	30	.4	16	7	5	4	0	43	41	16
	Grand totals...	163	275	342	114	203	159	165	170	80	727	652	292
	Percentages....	10	16	20	7	12	10	10	10	5	44	39	17
	Totals in 3 levels	438			818			415					
	Percentages....	26			49			25					

So much for the organization of the perceptions in cross-section; let us also regard the temporal course. We recall from Experiment 1 that processes indirectly evoked compose, almost exclusively, every phase but the first. Furthermore, the results of Experiment 3 show that these indirectly initiated processes are generally less clear than the visual sensations, which, in a large measure, occupy the focus of attention. Thus the perception temporally undergoes a reorganization not only with respect to kind of process but also in regard to the degree of clarity of the various components. In the first phase are usually to be found only visual sensations, but of maximal clearness, while in the second there are, as a rule, accessory processes, but standing at a lower level of clearness. This fact seems to indicate a decrease in clearness from phase to phase of the perceptual complex. In Table XII we have exhibited the relation of clearness between the processes of the first and second, and of the second and third phases of perception.

In order to maintain a constant standard, the changes were determined by the relation of the highest clearness values assigned in the two phases under comparison, *e. g.*, if both the first and second phases possessed processes of the first

TABLE XII

Observers	1st to 2nd Phase			2nd to 3rd Phase		
	—	+	*O*	—	+	*O*
C.....	50	25	13	29	19	6
De.....	27	7	4	8	6	1
Ra.....	29	13	9	8	2	1
Ru.....	53	6	30	26	16	17
Totals	159	51	56	71	43	25

degree, then they were considered as having undergone no change, but if the first phase contained a process of degree 1, and the highest of the second phase was of degree 2, it was considered as a decrease in clearness. C, for instance, out of 88 perceptions reported 50 decreases in clearness between the first and second phases, 25 increases, and 13 wherein there were no changes. The symbols —, +, and *O* signify a decrease, increase, or no change, respectively.

Table XII shows, then, that there is always a greater frequency of decreases in clearness than of increases or persistencies. This observation indicates that perception undergoes a change in clearness from phase to phase and usually a decline.

But the perceptual complex suffers not only with respect to clearness from phase to phase, but also in number of components. Inspection of the last three columns of Table XI will make it evident that, with the exception of C, every phase is less rich in processes than the one preceding. Thus perception declines both in clearness and in complexity of component members.

From this investigation we may draw the following conclusions:

1. The various areas of clearness within the perceptual complex, viewed in cross-section, differ as to the frequency of processes. The region of moderate clarity (degrees 3-6) comprises the greatest number of components, while to the perception the areas of focal distinctness and obscurity contribute unequal shares of the remainder. There were many more processes, however, in the obscure background which were wholly irrelevant to the perception and which have therefore not been included.

2. In perception, each large region of clearness also shows a predominance of some particular kind of process. The directly evoked processes lie, for the greater part, within the area of maximal clearness, while those indirectly evoked are usually moderately clear, and less frequently obscure.

3. There is usually a gradual decrease in the clearness and frequency of the various processes from phase to phase.

Nevertheless, just as we found in Experiment 2 that, although processes varied as to function, we could not decide on the basis of clearness and frequency alone which component was of the most importance to the perception, so in this experiment we cannot say whether processes with lower frequency but of greater clearness (directly evoked processes) are *ipso facto* of more importance to the perception than processes with a greater frequency and lower degree of clearness (indirectly evoked processes).

D. A Study of the Principal and Accessory Processes in Perception.

Problem and method. As a result of our experiments with objects possessing minimal or only slight significance, we have found that perceptions are composed of typical processes which display particular functions and which vary as to frequency and clearness. The processes are divided into those controlled by stimulus or directly evoked,—in our case the light sensations,—and those indirectly initiated, the kinaesthetic, organic, and imaginal processes. In this part of the investigation we have attempted to determine the relative value of the controlled and uncontrolled processes to the perception of highly significant objects. For this purpose a series of fifty miniature objects[70] was prepared and attached to cards, in order that they might be exposed in the tachistoscope. The objects were purposely chosen to call forth special imagery and kinaesthetic processes. We wished to find out whether the sensations immediately initiated, the imaginal processes, or the processes connected with organic movement bear the chief importance in the perception. According to our purpose, some of the objects were chosen for the possible initiation of auditory imagery (*e. g.,* the bell and whistle), others, for kinaesthesis (*e. g.,* the Indian clubs and hammer), others again (*e. g.,* the rose and sweet peas) to call forth olfactory images.

[70]The series given in the order of presentation included cloves, piece of rubber sponge, match and match-box lid, pickle, bell, burned cigarette, velvet, ginger-snap, scales, whistle, date, Indian clubs, chain, wet chamois, cherry and leaf (artificial), tennis racket, bottle of green liquid, hammer, loaf sugar, lantern with red glass, thumb-tack, rubber ball, coffee grains, slice of lemon, cannon, violets, sand-paper, ball-bat, striped candy, telephone, sweet peas, fur, suit-case, orange peel, firecracker, red rose, ice, dumb-bell, half of English walnut, peanut, slice of onion, red hot wire (heated by electric current), key, chocolate candy, stamp, celery, thorny twig, screw, slice of apple, and pitcher.

These objects were exposed for one second, and introspection was demanded for just the exposure period. The observers were Da, Ra, and Ru. The instructions were:

"Two seconds after a 'ready' signal, an object will be briefly exposed. Observe the object carefully. Give a full introspective account of the (1) meanings, (2) processes, sensational and imaginal, reporting upon their clearness as 'very clear,' 'moderately clear,' or 'very obscure,' and (3) temporal course of the perception."

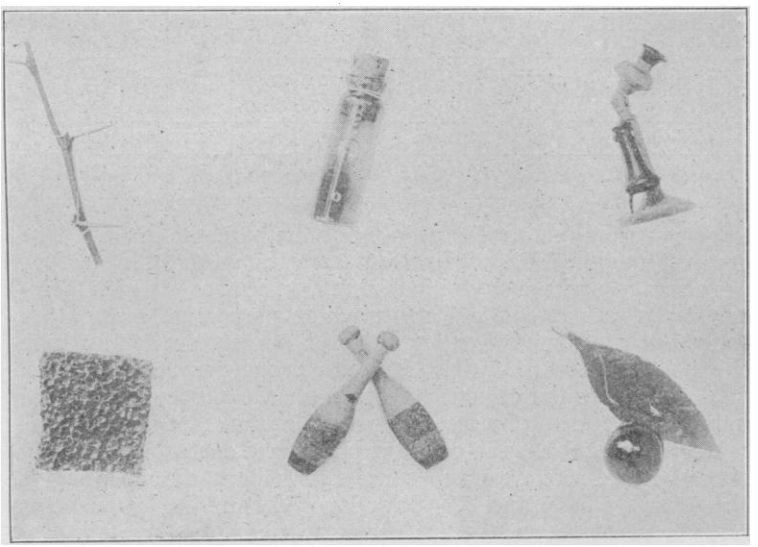


FIG. 2

Results. Table XIII gives a summary of the results of this experiment with respect to the frequency of the directly and indirectly initiated processes. 'P' and 'C' represent respectively peripheral and central processes, and '+' and '—' indicate whether or not a process or a complex was taken by the observer to add to the meaning of the perception.

The figures in the table make it evident (1) that the actual number of all kinds of accessory processes is about the same for perceptions of little or of much meaning (totals 73% and 76%); but (2) that the number of accessory processes *which are relevant and contributory to the perception* are much greater with elaborate (59%) than with slight (32%) meaning. (3) Where the meaning is considerable both the peripheral (36%) and the central (23%) accessories make

TABLE XIII

Obs.		Meaning Slight					Meaning Considerable				
		Direct	Indirect				Direct	Indirect			
			P		C			P		C	
		+	+	—	+	—	+	+	—	+	—
Da	Totals.....	8	9	**12**	3	3	42	**75**	32	**43**	17
Ra		12	1	2	**9**	3	45	**19**	3	**46**	7
Ru		5	6	**15**	2	2	45	**107**	25	**39**	8
Da	Percentages.	23	25	**36**	8	8	20	**36**	15	**21**	8
Ra		44	4	8	**33**	11	38	**16**	2	**38**	6
Ru		16	20	**50**	7	7	20	**48**	11	**17**	4
	Grand totals	25	16	29	14	8	132	201	60	128	32
	Percentages.	27	17	32	15	9	24	36	11	23	6

large contributions to the meaning of the perception. (4) The greatest modification of function appears with the accessory peripheral (organic and kinaesthetic processes) which principally go into intent and effort where perceptual meaning is slight but are incorporated within the perception itself where objects are more richly clothed with properties and relations. (5) A notable individual difference in the perceptual use of indirectly evoked processes appears in the fact that in the cases of Da and Ru the relevant peripheral accessories greatly exceed the direct (visual) complexes where the meaning is rich (for Da 36% and 20%; for Ru 48% and 20%), whereas in the case of Ra the central processes make the greatest contribution (38%).

The relative importance to the perception of the various processes may be considered from still another point of view,—that of attentional clearness. An inspection of Table XIV shows[71] that the visual sensations present the highest frequency in the focus, while the imaginal, organic and kinaesthetic processes are variously distributed throughout all three levels.

Certain differences among the observers must be considered.

Da and Ru are again alike in keeping their central or imaginal processes at a moderate or low degree of clarity, whatever the extent of meaning, (only 3% and 7% for 'very clear') and unlike Ra whose 'very clear' central processes stand at 33% and 27%. We also saw a moment ago that Ra's central processes are relatively numerous and

[71]The symbols c, m, and o represent the various levels of clearness: very clear, moderately clear, and very obscure.

TABLE XIV

Obs.		Meaning Slight									Meaning Considerable								
		Direct			Indirect						Direct			Indirect					
					P			C						P			C		
		C	M	O	C	M	O	C	M	O	C	M	O	C	M	O	C	M	O
Da	Totals.....	7	1	0	9	6	6	1	3	2	30	12	0	38	43	26	10	19	31
Ra		8	2	2	2	0	1	9	0	3	34	7	4	6	7	9	33	14	6
Ru		5	0	0	1	14	6	0	3	1	43	2	0	12	63	57	6	29	12
Da	Percentages.	20	3	0	36	17	17	3	8	6	14	6	0	18	21	12	5	9	15
Ra		30	7	7	7	0	4	33	0	11	28	6	3	5	6	8	27	12	5
Ru		17	0	0	3	47	20	0	10	3	19	1	0	6	28	25	2	13	6
	Grand totals.	20	3	2	12	20	13	10	6	6	107	21	4	56	113	92	49	62	49
	Percentages.	22	3	2	13	22	14	11	6	6	19	4	1	10	20	17	9	11	9

that they make a greater contribution to the perception than do similar processes of the other observers (Table XIII). On the other hand, Ra's organic and kinaesthetic sensations (peripheral accessories) which are fairly meagre show no decided tendency to seek a given level, whereas Ru's are chiefly 'moderate' or 'very obscure' (140 out of 153) and Da's chiefly 'moderate' or 'very clear' (96 out of 128). There seems to be no fixed relation between the clearness of these organic and kinaesthetic sensations and the contribution which they make to the perception, though this matter requires further experimental inquiry.

The results of this investigation indicate then (1) that although the sensations directly initiated compose but approximately 25% of all processes, nevertheless they are of fundamental importance to perception, since they are generally the clearest members and always bear some positive relation to the development of the meaning; (2) that the relative values of the indirectly evoked processes depend primarily upon the observer, both in respect to number, to enhancement of meaning, and to the clearness of the various processes.

There is still another very important question related to the analysis of perception which arises and may be answered from these results; namely, the absolute necessity of organic movement for perception. Each O reported the analysis of fifty perceptual complexes during this investigation. Out of that number, Da reported 10% and Ra 30% which involved no kinaesthesis or organic complexes of any type, sensational or imaginal. Ru discovered some symptom of bodily movement, general or localized, during every trial, although more than a fourth of the peripheral accessories were irrelevant to the perception. The fact that the observers reported complexes in

which such factors were either not present or were not involved indicates that the processes are not a necessity to the perception of objects. This conclusion is further substantiated by the results of Experiment 1, (Table II, Group IV) where over 8% of the perceptual formations brought under the 13 types lacked kinaesthetic or organic factors.[72] We may believe that in these and similar cases the perceptual meaning is simply and directly borne by the visual sensations and possibly the central accessories.

Chapter III

Summary and Conclusions

From the combined results of all our experiments, we may conclude that 'visual' perceptions tend, under our conditions, to present typical formations, which are composed of similar processes or members and are similarly organized or constituted. During the four experiments we have analyzed approximately 1500 perceptual complexes, all of which have revealed forms of integration the same as, or similar to, the standardized forms symbolized in Table II. We find the same component processes reported from perception to perception, whether the perception carries fragmentary, limited, or elaborate meaning. Again, we have found a progressive change in function of the various accessory processes coincident with the modification and the expansion of meaning. This modification will be made evident by a review of Experiments 1, 2, and 4 (3 used the devices of 1), where there is a gradual evolution in complexity of the materials used. The functional modifications seem to follow a definite, temporal sequence; (1) in perceptions with very little meaning, the accessory processes carry intent and they also serve to interpret the primary meaning as a 'nonsense' figure or blot, (2) in perceptions with more meaning, these processes not only interpret, but also aid in specifying and localizing the object and occasionally they are involved in appreciation, and (3) in perceptions with elaborate meanings, the specifying, localizing, and, especially, the appreciative functions become more and more frequent and elaborate. Finally, a general conclusion may be reached as regards the relative value to the meaning of the perception of the 'direct' and the 'indi-

[72] The results of a minor problem (conducted by Miss Davis, one of our observers) where the emphasis is laid upon this particular phase of perception seem further to support our facts. Three observers have thus far reported 44%, 21%, and 4% of their perceptions to be wanting in these peripheral accessory processes.

rect' processes. In all the experiments we have found a predominance of kinaesthetic and organic factors over visual sensations and imaginal processes. But, in spite of the predominance of kinaesthesis in the total number of perceptions, there have been reported in each investigation perceptions which did not involve any symptom of organic movement. The experiments indicate, then, that, although the results, sensational or imaginal, of organic movement are incorporated into many perceptual complexes, their frequent absence goes to show that objects may be perceived without their interposition.

Our results agree in general with the view maintained by several writers,—James, Bagley, Wallaschek, Lehmann, and Titchener,[73]—that the background, sensational or imaginal, is of fundamental importance to the meaning of perception. The kinaesthetic and organic sensations and the imaginal processes under our conditions have consistently formed a setting for the central visual complex, and have supplied more of the derived significance than the 'directly' initiated processes themselves. But we should not go so far as to contend that this 'context' is the meaning,[74] since the process itself is always to be considered as distinct from its function. When meaning is described no single process or group of processes, focal or marginal, can be looked upon as the meaning of the whole complex, but we must consider all of the integrated members as a unit. When we consider that meaning presents stages of elaboration, the lowest being the bare apprehension of a 'meaningless' object, the directly evoked process become of more importance to the significance in the lower stages than the 'fringe' or 'context.' This latter then functionates as a forced searching or seeking for derived, elaborate meaning, which usually fails. Nevertheless, as meaning becomes more elaborate, the accessory processes acquire increasing importance.

Since we have contended for an intimate relation between meaning and process, we cannot agree with the exponents of 'imageless' thought that the two are separate processes. Moore,[75] who has attempted to prove by experiment the presupposition, seems to have fallen into a twofold error; first, he has failed to take into account the stages of elaboration of meaning and, secondly, he has assumed that, if imagery and meaning were synonymous, then imagery must refer to the stimulus itself. Only very elaborate, derived meanings are considered in his results, and as the introspections of our observers show that perceptions under such conditions are very complex, we suspect that Moore left out of account the greater share of contributory processes. As regards imagery, our own results make it appear that the memory-image of the object, whether visual or kinaesthetic, was

[73]James, W., *op. cit.*, I, 258; Bagley, W. C., The apperception of the spoken sentence; a study in the psychology of language, *Am. J. of Psychol.*, 1900, xii, 80; Wallaschek, R., *Psychologie und Pathologie der Vorstellung*, Leipzig, 1905, 188; Lehmann, A., *Grundzüge der Psychophysiologie*, Leipzig, 1912, 603; and Titchener, E. B., *A textbook of psychology*, N. Y., 1915, 367ff.

[74]Titchener, E. B., *ibid.*, 367.

[75]Moore, T. V., The temporal relations of meaning and imagery, *Psychol. Rev.*, 1915, xxii, 177.

much less frequent than images with derived meanings all of which bore a direct relation to the total signification. A comparison, then, of the reaction-times of meaning and of imagery, directly referring to stimulus, would not be a fair determination of the relation of the meaning to imagery, since a good number of the relevant imaginal processes have been disregarded. A qualified statement of this problem by Tolman,[76] while it specifies too far, accords better with our own results.

Our experimental researches seem, then, to justify the following generalizations:

1. 'Visual' perceptions present a number of typical formations, each of which presents its own peculiar mode of integration and is marked by a distinctive temporal course. These formations are variously based upon three kinds of mental processes, (1) visual sensations directly evoked by stimulus, (2) kinaesthetic and organic sensations indirectly evoked (peripheral accessories), and (3) imaginal materials drawn from various sources (central accessories).

2. All 'visual' perceptions of our class have the same general constitution. The visual sensations, directly evoked by stimulus, are usually the clearest processes within the perceptual pattern, while the accessory processes lie chiefly in the region of moderate and limited clearness. The obscurest processes were, for the greater part, not relevant to the perception. During the temporal course of the perception, typical modifications occur, *i. e.*, (1) there is a gradual decrease in the number and clearness of the processes from phase to phase, and (2) there is a readjustment of the various factors themselves, the visual sensations tending toward obscurity while the accessory processes become relatively more prominent.

3. Spatial perceptions of the kind exemplified in our experiments fall into four classes as regards the kind of functions which they perform; namely, figurational ('nonsense' figures), depictive (presentations of specific objects), abstract (reference to a kind or class of objects), and symbolic (a secondary meaning which transcends the 'presented' object). The first correspond to objects which are frequently called 'meaningless,' the second to the customary apprehensions of sense (perception taken in the usual way), while the third and fourth suggest functions which are either intermediate between or else common to perception and thought.[77]

4. The component processes fulfil different functions

[76]Tolman, E. C., More concerning the temporal relations of meaning and imagery, *Psychol. Rev.*, 1917, xxiv, 138.

[77]A special study of these 'higher' forms of perception is well advanced in the Laboratory.

according to the degree of cognitive elaboration. Where the meaning is minimal or slight (as in the bare apprehension of an irregular 'nonsense' figure), the processes first bear the meaning and secondarily reenforce (in the form of effort or intent) a self-instruction to seek further significance in the figure. Where the meaning is moderate or complex, the accessory processes may give in addition a value to the object perceived (appreciative function) or they may establish it in its spatial and temporal relations (localizing function).

5. Meaning is only loosely correlated with the number and degrees of clearness of the indirectly initiated processes (peripheral and central accessories).

6. Kinaesthetic processes are not invariable components of spatial perceptions.